AN INQUIRY INTO THE EXISTENCE OF OPTIMUM FINANCIAL STRUCTURES

By

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This dissertation is an empirical study concerned with testing for the existence of optimum financial structures. A secondary consideration is to determine whether an industry classification of firms or an earnings variability classification provides a better method of grouping firms for purposes of studying and explaining financial structure patterns.

Evidence in support of the traditional position on financial structure is provided by the results of the one-way analysis of variance performed on the common equity ratios of 77 corporations classified into 12 industries. The hypothesis tested is that financial structures, represented by common equity ratios, differ significantly between industries. The period covered is 1959-1968. The results of the analysis of variance for each year exceed by a wide margin the F-ratio needed for significance at the 1 percent

level. Using the results of the analysis of variance of equity ratios, a pariwise test for each year is performed. The results of the pariwise tests indicate that the financial structure differences are rather pervasive among the industries studied. This evidence lends support to the traditional theory that an optimum range of leverage exists for a particular industry and that firms seek to find this optimum range.

A second approach is taken in seeking to identify significant financial structure patterns among firms. The same sample of 77 firms is used, but the industry approach to approximating business risk is dropped and replaced by an earnings variability approach. The variability measure used is the antilog of the standard error of the regression coefficient of a log-trend regression. This provides a percentage variation around a least-squares growth rate for the particular income stream used in the calculation. Two income streams are used. These are: (1) earnings before interest and taxes, and (2) operating income before depreciation. By taking each of these income streams on a per share basis for three periods of time, six measures of variability are derived for each firm. Variability risk classes are then arbitrarily constructed and the 77 firms are grouped into either four or five classes ranging from low

variability to high variability. The analysis of variance procedure is then used to test for significant differences in financial structures between these variability risk classes. In only two of the six cases tested are significant results obtained, and in one of these the null hypothesis of no significant differences is rejected at the 25 percent level. The evidence does not support the traditional view that financial structures vary with earnings instability. It is concluded that an industry grouping of firms is more appropriate than an earnings variability classification in explaining differences in the financial structures of firms.

In order to test further the validity of using an industry classification of firms as an approximation of the equivalent risk class, the analysis of variance is performed on earnings variability by industry for each of the six measures of variability derived in the study. The null hypothesis of no significant differences is rejected in all six tests. Three of the rejections occur at the 5 percent level of significance, two at the 10 percent level, and one at the 25 percent level. This evidence permits the conclusion to be drawn that earnings variability differs significantly between industry classes, and adds weight to the use of industry groupings for approximating equivalent risk classes.

CHAPTER I

INTRODUCTION

The Problem

A central problem of financial theory and practice concerns the importance of the financial structure of the firm. A dichotomy of opinion has arisen in regard to the effect of financial leverage on the overall cost of capital funds to the enterprise and, hence, on the value of the enterprise. In order to place the major problem area of this study in perspective, the opposing theories, the traditional position on one hand and the independence hypothesis on the other, will be briefly introduced.

The advocates of the traditional view hold that the firm can alter its cost of capital by changing its financing mix. The substitution of debt for equity will at first lower the firm's cost of capital due to the favorable effect of financial leverage on earnings available to the common stockholders and due to the fact that in most cases debt is cheaper than equity. Beyond a point, however, due to excessive risk, investors will not react favorably to further

increases in the degree of leverage used by the firm, so the cost of capital funds will rise. The advocates of the traditional view, therefore, assert that there is an optimum financial structure; it is the financial structure which minimizes the overall cost of capital to the firm.

Taking basic disagreement with the tenets of the traditional view are the proponents of the independence hypothesis. The theorists supporting the independence hypothesis argue that, given certain conditions, the overall cost of capital is not influenced by the firm's financing mix. The favorable effect of substituting low-cost debt for high-cost equity in the firm's financial structure will be exactly offset by a decrease in the price that investors are willing to pay for the firm's common stock. A higher common equity yield is demanded by investors in return for being exposed to greater financial risk. The cost of capital is independent of the financial structure of the firm, so an optimum financial structure does not exist.

The major objective of this study is to test for the existence of optimum financial structures. This will be accomplished by analyzing the common equity ratios of a sample of 77 corporations involving 12 industries. The time period under consideration is 1959-1968. A secondary objective is to ascertain whether an industry classification of firms or

an earnings variability classification provides the better surrogate for business risk in seeking to explain financial structure patterns.

Organization

The next chapter develops in detail the major theories of financial structure just identified as the traditional position and the independence hypothesis. The traditional position will be taken through three periods of development labeled formative, transitional, and formalization. The development of the independence hypothesis will likewise be documented; but as this has occurred over a relatively short period of time, the analysis of discrete time periods is not needed. This discussion of both theories will bring the differences between them into focus.

Chapter III reviews several empirical tests of the effect of leverage on the cost of capital and value of the firm, and on the question of observable optimum financial structures. The objective of reviewing these empirical studies is to illustrate difficulties involved with certain statistical approaches and to justify the statistical approach taken in this paper. This chapter also states the hypotheses to be tested and describes the methodology to be used in carrying out this testing.

Chapter IV contains the empirical findings and con-

clusions drawn from the industry analysis. The general approach is to group the firms in the sample by industry and test for significantly different common equity ratios among the several industries.

Chapter V reports the empirical findings and conclusions from the earnings variability classification of firms. Instead of grouping firms by industry, an earnings variability measure of business risk is used to group the firms. The common equity ratios between variability classes are then tested for significance.

Chapter VI, the final chapter, summarizes the study and states the conclusions drawn from it.

CHAPTER II

AN HISTORICAL EXAMINATION OF THE SUBJECT OF OPTIMUM FINANCIAL STRUCTURES

The Area of Investigation

An occasional prod or challenge to a generally accepted method of analysis or loosely stated proposition can provide the catalyst that accelerates both theoretical and empirical research efforts in a specified field of knowledge. It is only necessary to consider for a moment the impact of John Maynard Keynes (27) on the area of economic analysis, or Wroe Alderson (1, 2) on the area of marketing management, or John Gurley and Edward Shaw (19, 20) on the monetary theory area, and it becomes clear that some of the best works in these economic-related fields have arisen out of controversy and disagreement. This has also been the case with the field of corporation finance.

Having emerged at the turn of this century from the field of economics as a separate academic discipline (56), financial management has undergone its most significant transformation in the past 15 years. There has been a shift in the major areas of emphasis from institutional, legal,

and accounting relationships to an analytical approach that deals with investing, financing, and dividend decisions. Where once mere description of capital markets, financing instruments, and financial management practices was adequate, both academic theorists and practitioners now require explicit statement of verifiable hypotheses and the quantitative analysis of empirical data related to these hypotheses (57, p. 16; 51, pp. 1-6).

This new emphasis in the finance field has charged financial management with the responsibility for finding answers to three questions (47, p. 8):

1. What specific assets should an enterprise acquire?

2. What total volume of funds should an enterprise commit?

3. How should the funds required be financed?

This study will be concerned with the last of the above three questions. The problem to be identified and discussed will deal with the manner in which the firm has financed the assets at its disposal, that is, the financial structure of the firm.

This chapter consists of an extensive review of the literature that relates to the two major viewpoints concerning financial structures. The unifying theme is that the shift in emphasis which has occurred in the field of

financial management has been motivated to a large extent by numerous theoretical and empirical studies concerned specifically with the subject of financial structures.

Definition of Terms

In order to provide clarity and avoid possible ambiguity as to meaning, some terms that will be used throughout this study must be identified and defined.

Financial Structure and Capital Structure

This study will use the term, financial structure, to refer to the method of financing a firm's assets (59, p. 304). Financial structure therefore refers to the mixture of the various sources of funds which have permitted the company to purchase the assets with which it operates. For purposes of analysis the right-hand side of the balance sheet can be divided into four main areas: current liabilities, long-term debt, preferred stock, and the common stockholders' investment, including retained earnings and any surplus accounts. The term, financial structure, emphasizes the proportion of each of these four major sources of funds in relation to the total book value of the financial structure. The book value of the financial structure is a quantitative amount and represents the sum of the liabilities and ownership claims on the firm.

Some studies of financing patterns focus upon the capi-

tal structure of the firm. The difference between capital structure and financial structure is that the former excludes current liabilities from the financing mix under consideration. The book value of the capital structure, then, is the sum of its long-term debt, preferred stock, and common stockholders' investment.[1*]

As has been mentioned by Schwartz (44, p. 101), the broad definition of financial structure that has been adopted here is more meaningful for purposes of studying financing patterns than is the concept of capital structure. This results because the capital structure of the firm is made up essentially of outstanding stocks and bonds; therefore, the exclusive use of the capital structure concept would ignore the high degree of substitutability that exists between the various sources of short-term and long-term funds available to the particular company.[2]

Optimum Financial Structure and the Cost of Capital

It is the contention of many writers on financial theory that for a particular firm some financial structures are better than others and, further, that an optimum financial structure exists. Following Weston and Brigham (59,

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*Superior figures refer to notes at end of chapter.

p. 359), the optimum financial structure of the corporation is the financial structure that will minimize the cost of raising a given increment of funds. This means that if this given increment of funds is not raised according to the optimal mixture, higher implicit and explicit costs will be incurred.[3]

The cost of capital funds to the firm is more easily defined than it is measured, but the method of analysis of this study is not dependent on measuring the cost of capital or the effects on the cost of capital caused by different types of financial structures. At this point, a description of the cost of capital will suffice which indicates how the concept should be used by the firm and the effect on the value of the firm from this use.

Solomon has identified the function of the cost of capital as follows:

> Its function is to provide a correct and objective criterion by which management can determine whether it should or should not accept available proposals involving the expenditure of capital. (46, p. 128)

The cost of capital becomes the fundamental standard of investment worth and is commonly referred to as the cutoff point for capital expenditures (47, p. 27).

Where Solomon has provided an operational definition of the function of the cost of capital, in the following state-

ment Gordon indicates what the result on the value of the firm will be from the use of this operational concept:

> The cost of capital for a firm is a discount rate with the property that an investment with a rate of profit above (below) this rate will raise (lower) the value of the firm. (16, p. 218)

Gordon has emphasized the point that a proposed use of corporate funds must earn a rate of return greater than the cost of the funds that the project employs, or over some rather indefinite time period the market price of the firm's common stock will be adversely affected.[4]

It must not be overlooked that the cost of capital is a composite discount rate reflecting the costs of all sources of funds that the firm employs.[5] The costs at which funds from each source are obtainable are determined in the capital market and are affected by a variety of factors, including the financial structure of the firm. This provides the close relationship between the cost of capital and the optimum financial structure and makes discussion of one without the other an exercise lacking in substance. The theory of an optimum financial structure, then, asserts that the cost of capital will be minimized when that optimum financial structure has been reached and maintained.

Financial Leverage and Financial Risk

Few terms in the field of finance have the capability

of commanding attention as does the term, financial leverage.[6] Because of the importance of this concept to both the theorist and the practitioner, financial leverage is often elevated to the status of a principle (22, p. 167). Financial leverage is employed by the firm if it uses funds for which a limited payment is incurred. The firm uses funds obtained at a fixed cost in the hope of increasing the rate of return to the common stockholders. Leverage is favorable or positive if the rate of return on assets financed by funds bearing a limited return exceeds the explicit cost of these funds. Unfavorable or negative leverage results if the rate of return on assets financed by funds bearing a limited return is less than the explicit cost of these funds. With favorable leverage the rate of return on the common equity investment is greater than if the firm were unlevered, and with unfavorable leverage the rate of return on the common equity investment is less than if the firm were unlevered. Such is the double-edged sword of financial leverage, which is often referred to as the magnification effect.[7]

Financial leverage is usually discussed in terms of interest-bearing debt or preferred stock instruments; however, from the standpoint of the common stockholder, non-interest-bearing current liabilities also provide financial

leverage. This is because earning assets are financed by such liabilities, thus magnifying the rate of return on the common equity investment in relation to what it would have been had these same assets been financed by the sale of additional common stock or the retention of earnings.

The levered firm exposes itself to a type of uncertainty called financial risk.[8] As the proportion of securities bearing a fixed rate of return in the financial structure of the firm is increased, the residual-earnings stream to the common stockholders is exposed to risk of increased variability. This fluctuation or variability would not be present if the firm were unlevered. In addition to an added factor of variability, the firm suffers from an increased possibility of insolvency. This arises because of the contractual nature of interest and principal repayments associated with debt instruments. Financial risk, therefore, exposes the common stockholders to increased dispersion of earnings and to increased probability of insolvency.[9]

Financial risk occurs for a particular firm because of a definite policy decision having been made which is reflected in the financial structure of this firm. The decision has revolved around whether or not the firm should issue securities bearing a limited return in anticipation of

earning a return greater than the cost of the funds, thereby having the difference accrue to the common stockholder. Should the firm decide to lever the earnings stream available to the common stockholders, or not? If affirmative action on this problem is taken by the firm, then financial risk is assumed.

Business Risk

The firm is constantly vulnerable to another type of risk, independent of financial risk, which will be identified as business risk or business uncertainty. Business risk is discussed in terms of fluctuations in an earnings measure which has not had any financial fixed charges deducted from it. The accounting concept of net operating income fits this criterion.[10] Business risk, therefore, can be measured by the relative dispersion in the stream of net operating income. Factors that affect the dispersion of net operating income have been described by Solomon as follows:

> These factors include general expectations with respect to overall economic and political trends, specific expectations about the particular regions and markets within which the company acquires resources and sells its products, and the speed and flexibility with which the company can lower its total operating costs when total revenues decline. (47, p. 71)

It appears to follow rather logically that the ability of the firm to use financial leverage advantageously and to

assume the concomitant financial risk is a function of the business risk to which the firm is subject.

This introduction to some common terms used throughout the literature of finance is concluded. It should pave the way for a more lucid discussion of opposing theories on the effect of financial structure on the cost of capital and value of the enterprise.

The Traditional Position on Financial Structure: Development and Meaning

Introduction

Two divergent viewpoints concerning the effect of a firm's financial structure on its cost of capital have been increasingly present in the literature of finance since 1958. The more traditional view holds that the overall cost of capital to the firm is to some degree a function of the amount of financial leverage that the firm employs. By combining debt and equity in the proper amounts, according to the traditional view, the cost of capital will be minimized and the market value of the firm maximized. The question of the financial structure of the firm, then, becomes a critical one in the traditional framework developed to guide financial management. The traditional position on financial structure emphasizes two advantages to be gained by the firm from the wise use of financial leverage. First, the earnings

available to the common stockholders will be magnified, and second, for most firms debt is cheaper than equity.[11]

An opposing view concerning the relationship of financial structure to valuation was presented in a celebrated 1958 article by Franco Modigliani and Merton H. Miller (36). The Modigliani and Miller argument, often referred to as the "independence hypothesis," holds that the total market value of the firm is not affected by the mixture of financing sources used by that firm.[12] Within the Modigliani and Miller restricted environment, which precludes the tax deductibility of interest expense for corporate income tax purposes, an optimum financial structure is non-existent.

These two theories on the relationship of financial structure to the cost of capital and the valuation of the enterprise will now be discussed in more detail. The development and meaning of each theory will be examined. It will be shown in the initial discussion that for a rather long period of time the traditional view on financial structure was not formalized. Rather, unified statements of the traditional approach grew out of the challenge of the independence hypothesis to the traditional position.

Development and Meaning

A progressive flow of ideas characterizes any field of inquiry, as does repetition of ideas. Recognizing that no

classification of periods will eliminate repetition, it is felt that the following will permit an orderly presentation of the traditional view of financial structure and also will allow meaningful contrasts within periods:

1. The formative period--1910-1930.
2. The transitional period--1930-1950.
3. The formalization period--1950-1960.

A fourth period could be called "the period of empirical testing" and would begin with 1960 and extend to the present. But such a period belongs to both the traditional and independence hypothesis viewpoints and, in effect, will be discussed in a separate section in Chapter III.[13]

The formative period

Early texts documenting the financing behavior of corporations contain the basic concepts that form the traditional view of financial structure. It will be seen that the concepts of trading on the equity, business risk and financial risk, and the position that debt may be cheaper than equity are described in works published prior to 1920.

It was stated earlier that the principle of financial leverage has a central role in the theory of finance. This has been the case for an extended period of time. A work entitled Capitalization: A Book on Corporation Finance was published by Hastings Lyon in 1912 (32). The second chapter

of this text is "Trading on the Equity," and the principle involved is thoroughly presented. Proper attention is given to the fact that financial leverage can have either a favorable or an unfavorable effect on earnings available to the owners of the firm depending on the direction of the change in earnings before interest and taxes (32, pp. 51-52). Lyon's discussion about the effects of leverage on rates of return to common stockholders is done entirely in terms of explicit costs. Nowhere in the volume is there an indication that an increased use of leverage, which would raise the rate of return on invested capital to the common stockholders, might be offset by a falling common stock price due to the increase in financial risk.[14] The following passage from Lyon will tend to substantiate this point:

> The trader on the equity in the case of a corporation is the common shareholder. Holders of other corporation securities are taking shelter under the protection of the equity of the invested capital of the common shareholders, and the common shareholder takes advantage of the protection he offers by his capital to get other funds into the business on terms that he expects will make his own capital more profitable than it would be otherwise. (32, p. 53)

Lyon's statement is a forerunner of what Hunt (24, p. 83) has chosen to designate as trading on the equity or balance sheet leverage. According to Hunt, balance sheet leverage should be measured by the ratio of the rate of return on the existing common equity to the rate of return on the entire

capital structure as it would have been with only common equity outstanding. When Lyon speaks of leverage being incurred so that capital will be more profitable than it would be otherwise, he states in loose terms Hunt's measure of balance sheet leverage.

Additional identification and use of terms and concepts thought to be rather "new" is provided by this 1912 publication of Lyon. Business risk is contrasted with financial risk, and a rising marginal cost of debt curve is succinctly described (32, pp. 54-56). The relation of financial risk to an increased cost of debt financing can be gathered from the following:

> The thinner the equity or margin the shareholder works on, the greater the risk that the shareholder runs and that he places on the bondholder. As the equity gets thinner, interest charges increase more rapidly than the increase in the capital advanced. (32, p. 55)

Lyon has clearly stated that, as leverage is increased, the financial risk of the shareholder has increased, and a rising debt to equity ratio will cause the lenders of capital to demand higher interest rates as compensation for this increased risk.

Another glimpse of the flavor of the writing on financial structure during the formative period can be gained by reviewing some opinions of Edward S. Mead offered in his 1915 publication, Corporation Finance (34). His fifth chap-

ter, "The Issuing of Securities," and his eighth chapter, "The Issue of Stock," contain observations pertinent to the traditional position. He relates the importance of earnings stability or variability to the ability of the firm to incur financial leverage and classifies an industry according to a risk measure, in addition to identifying the concept of a debt limit.[15] Consider the following from Mead:

> In estimating the stability of different classes of enterprises to furnish security for bond issues, we must take account first of this factor of earnings.
>
> Since the bondholder is solely interested in the security of his principal, and regular payment of his interest, and since both security and interest depend upon the permanence of income, other things being equal the companies with the most stable earnings or a market for their products at all times . . . furnish the best security for bonds. . . .
>
> We may classify enterprises according to the quality of the security which they offer for an issue of bonds. . . .
>
> The amount of bonds should not be so great as to impose upon the corporation a burden of interest charges which is above, or even equal to, a conservative estimate of the earning power of the company under the worst conditions which it is likely to meet. (34, pp. 62-64)

Mead has indicated that the variability of earnings available to meet interest charges bears an important relationship to the ability of the enterprise to issue debt-type instruments. The variability of earnings before interest and taxes will play a central role in the study to be conducted herein. Mead also implies that firms can be classified according to a basic measure of business risk,

that is, the stability of earnings. In addition to this, Mead provides an indication of what a theoretical debt limit should be based upon, not unlike what Donaldson (11, p. 288) has referred to as the "maximum adverse limit," except Donaldson's discussion is in terms of cash flows. Here, then, is a work by an early author that must be commended for the identification and definition of several terms that play a critical role in current financial theory.

Because of his profound impact on the academic side of the business finance field for approximately three decades, the work of Arthur Stone Dewing during the formative period should be described. Dewing (7), in the 1921 edition of his renowned and detailed The Financial Policy of Corporations, does present some arguments that are traditional in their nature; however, in relation to current discussions and disagreements on the importance of financial structure, his early work is not as vital to the development of the traditional theory as is that of Lyon. For instance, where Lyon devoted an entire chapter in his 1912 text to the effect of trading on the equity on the rate of return of the common stockholders' investment, the magnification effect of financial leverage is not mentioned in the early editions of Dewing's monumental work. In fact, a complete example and discussion of the magnification effect of trading on the equity

is not available in Dewing (8, p. 731) until his third revised edition published in 1934.

Still, Dewing provides reinforcement for a growing body of thought on financial structure that is to become known as traditional. Clearly, the following indicates that he is of the same general mold as Lyon and Mead:

> There are certain specific advantages which the issue of bonds affords, not ordinarily possessed by a new issue of stock. The most apparent is the lower rate at which the new capital for expansions may be secured through bond issues rather than stock issues. . . .
>
> If the amount of earnings can be predicted with some degree of certainty, bonds should be issued up to a reasonable amount, as the new corporation can obtain money from the sale of bonds much more cheaply than through the sale of any form of stock. (7, Vol. IV, p. 181, and Vol. II, p. 44)

It is noted that Dewing adheres to the view that the issuance of debt will provide the firm with a lower cost of capital than if all equity sources are used, and also that the regularity of the expected earnings stream is a significant aspect as to whether or not fixed-charge financing should be used by the enterprise.

Formative period--summary.--The formative period produced the following major concepts and ideas associated with the development of the traditional view on optimum financial structures:[16]

1. The magnification effect of trading on the equity is a two-way proposition providing both favorable and unfavor-

able effects on the common equity investment, dependent on the direction of change in earnings before interest and taxes.

2. The firm is subject to the basic business risks of the industry in which it operates and may subject itself to financial risk if the decision to use fixed-charge financing is made.

3. Firms will tend to employ financial leverage because securing funds for investment through debt instruments is usually cheaper than raising the same amount of funds by means of an equity issue. Debt therefore is considered less expensive than equity, but a rising marginal cost of borrowing will effectively limit financial leverage.

4. The stability of the earnings stream available to meet the fixed charges that arise from debt or preferred stock financing provides an indication of the proper amount of financial risk which the firm should assume.

The transitional period

The foundation for the traditional view on financial structure was firmly laid during the 1910-1930 period. The transitional period, covering the 1930-1950 era, provided a strengthening of this basic foundation. It is felt that the works to be discussed provide an unbiased view of the field of corporate finance during this period of years. It will

be seen, however, that more elaboration than progress is made in fitting the effect of financial structure into a valuation framework. During the transitional period, two distinct types of presentation emerge. Much work in the corporate finance field during the thirties and forties was of a descriptive nature, and this is characterized by the general texts published by Burtchett (6) and Guthmann and Dougall (21). In contrast to this type of approach, a more analytical presentation is apparent in the works of Williams (60) and Buchanan (5). Some of the thoughts of these writers on the subject of financial structure will now be considered.

Floyd F. Burtchett (6) published a text on corporate finance in 1934. In relation to the works of Lyon (32) and Mead (34) previously discussed, Burtchett's text is considerably more detailed but his discussions of the financial structure of corporations are not significant, forward steps. The terms mentioned will, therefore, be familiar.

Burtchett indicates that the firm's decision to incur debt will be influenced by the stability of its earnings. He also states that the cost at which the debt will be supplied to the firm is affected by its stability of earnings (6, p. 391). The idea of a debt limit being imposed by investors is explored (6, pp. 396-397), a table of suggested financial structures is provided (6, p. 355), and a cost

constraint on the amount of financial leverage to be incurred is identified (6, p. 404).

The presentation of Burtchett relating earnings stability to the advisability of issuing debt is not much different from that of Mead, but his thoughts on an investor-instituted debt limit warrant further comment. Burtchett is of the opinion that rigidities in the capital markets impose limits on the amount of debt which certain corporations are able to incur.

> Over a period of years the experience of investors in corporations will gradually erect standards by means of which they will be inclined to favor or disfavor borrowing operations by a corporation. . . . Indeed, as a corporation borrows more and more, the increasing resistance encountered in securing money in the capital markets of the country, although perhaps a mental state, is a real and seemingly insurmountable barrier which finally limits the borrowing operations of the corporation. Whether or not these barriers are scientifically arrived at, or are based upon indefensible tenets, they exist and must be admitted in any determination of the borrowing policy. (6, pp. 396-397)

This passage is offered for examination because Burtchett has identified what can be called an institutional rigidity. The independence hypothesis, which will soon be discussed, does not allow any such rigidities into the analysis (36, p. 97). Here, then, is an author writing 24 years prior to the foundation article on the independence hypothesis, taking the stand that institutional barriers are significant and limit the amount of debt which a firm is able to

float. Clearly, Burtchett has come extremely close to stating that an optimum amount of debt can be issued by an enterprise. What is lacking is a framework that relates the degree of financial leverage to the valuation of the enterprise.

The institutionally imposed limit is one of two constraints on the degree of corporate fixed borrowing identified by Burtchett. This institutional restriction is supposedly set by investment practice, and is not determined by any objective criterion that the firm has devised. A rule-of-thumb of two dollars of fixed assets being supported by not more than one dollar of debt is suggested as having some practical substance.

Providing the other effective limit to corporate borrowing is the cost of the borrowing. Burtchett implies that the cost of capital funds to the firm will first fall as more debt is issued, then will rise if the institutionally set debt limit is exceeded. The germ of the formalized traditional position on the relation of the cost of capital funds to financial structure is seen in the following:

> Another limit effective in every corporation, irrespective of size, nature of business, or reputation as to management, arises through the increasing cost of borrowing. As the corporation extends its borrowing up to the limits which circumscribe it, each successive dollar borrowed costs more and more. In fact, it is the increasing cost of obtaining additional funds which always stops borrowing, for in an institution impelled by a profits motive, an ac-

> tion which is profitable, once set in motion, will continue until it is counteracted by losses from another source. Capital will continue to be borrowed just as long as the stockholders find it to their advantage to borrow. It is only when additional borrowing cannot be done except at a cost exceeding the income that all borrowing will cease. (6, p. 404)

The implication of a saucer-shaped cost of capital curve is strong. Burtchett has stated that borrowing will continue as long as stockholders benefit from the borrowing, thus indicating that some degree of borrowing is indeed advantageous; therefore, a falling cost of capital is tacit. Then he relates that borrowing will cease when it is no longer profitable; thus the cost of funds has risen and the cost of capital curve has turned upward. Once a saucer-shaped cost of capital curve is hypothesized, the existence of an optimum financial structure becomes a corollary to that hypothesis. The difficulty with most of the early and transitional writers on corporate finance is that the saucer-shaped cost of capital curve is not really hypothesized and tested but is discussed as being so logical that testing appears to be a redundant exercise.[17]

Guthmann and Dougall's (21) Corporate Financial Policy, which first appeared in 1940, provides explicit statements of what is now considered the traditional view on financial structure. The apparent advantages of trading on the equity

are related to the price of the firm's common stock, something which is not stated specifically by the other works previously mentioned in this development of the traditional theory. In discussing how the issuance of debt will lower the cost of funds to the firm, Guthmann and Dougall put forth:

> . . . the judicious use of debt for the purpose of making as good an investment record as possible for the common stock will enable the corporation to finance with a minimum of difficulty. (21, p. 115)

The implication is rather straightforward; that is, raising the rate of return on the common equity through favorable financial leverage will be reflected in a common stock price higher than it would be in the absence of such leverage.

Guthmann and Dougall are equally clear in discussing the constraints on the use of financial leverage. They suggest that debt financing should be limited by three factors. First, the firm itself should only consider debt financing if stability in the earnings available to the holders of the debt security is expected. Second, as did Burtchett, Guthmann and Dougall suggest that excessive trading on the equity will be prohibited by a rising cost of borrowing due to the added financial risk caused by excessive leverage. Third, and again similar to Burtchett, institutional rigidities which create debt limits according to common usage are envisioned as a deterrent to borrowing.

In sharp contrast to the popular texts described, this transitional period in the development of the traditional position on financial structure produced two works that seem in their overall content at least two decades ahead of their time. These are the contributions of John Burr Williams (60) and Norman S. Buchanan (5). Both of these works contain notions which are traditional in their nature.

Williams, in analyzing the value of a utility firm with a constant degree of leverage, infers that an optimum financial structure exists when he says:

> . . . assume that the company has already adopted the capital structure most favorable to its stockholders, and that it therefore maintains a constant ratio of bonds to stocks as it continues to grow. (60, p. 129)

To Williams the most favorable capital structure is one which contains some leverage:

> Advantageous to stockholders is a capitalization top-heavy with bonds if the interest rate on the bonds is low. . . . (60, p. 151)

An analogy is then presented in which he likens the advantage to the common stockholder from favorable financial leverage to the bank which secures deposits for only the cost of servicing the account and then invests this low-cost money in high-yielding loans.[18]

Finally, Williams relates the general movement of common stock prices during the period 1921-1929 to the use

of financial leverage by individual firms. His statement indicates that over some ranges of leverage the price of a firm's common stock will rise:

> The presence of bonds and preferred stocks in corporate capitalizations made the benefits of inflated earnings converge on their common stocks, and caused a rise in the stock averages far greater than that already registered by the commodity averages. (60, pp. 412, 414)

Where Williams was able to integrate corporate financial practice into a general theory of investment worth, Buchanan provided an analysis which integrated the microeconomic theory of the firm with financial management and policy.

In relation to financial structure theory, it can be stated that Buchanan makes three main points. First, there is such an objective of economic activity as seeking an optimum financial structure. Consider the following:

> The primary aim in drafting the financial plan is to discover that "ideal" combination of security contracts which will raise the capital on terms most favorable to the new enterprise, which, as we have already indicated, means most favorable to the common stockholders. (5, p. 174)

Notice in the above that Buchanan clearly views corporate activity from the standpoint of the common stockholder, and, further, he apparently believes that different combinations of the sources of capital will in different ways affect the position of the common stockholder.

The second main point made by Buchanan in relation to the financial plan is to stress the importance of regularity or stability of income as a significant factor affecting the composition of that plan. By this time it is evident that stability in the income stream available for financing charges is deemed important by most contributors to the area of business finance.

Buchanan's third point has the most substance. In discussing the economic basis and justification of expansion of the firm, he notes that acquisition of assets through a borrowing arrangement can add two types of cost to the common shareholder. First, there will be an increase in the amount of interest charges which must be met, and second, the shareholder will be exposed to more risk because of the threat of insolvency. Because the holder of the debt security and the common shareholder in the firm view these risks from opposite poles, it is likely that the shareholder will place a different valuation on the risk of borrowing. The inference seems to be that added borrowing could cause investors to alter their opinion as to the present worth of the firm's anticipated earnings stream and thus affect the price of the firm's common stock. If the returns from the asset financed with the debt instrument exceed both the cost of the interest incurred and in addition compensate for the added risk of in-

solvency, then the common stock price would not suffer and expansion would be justified. Few writers before Buchanan hinted that added borrowing could result in a less favorable valuation of the firm by both existing and potential investors.[19]

Transitional period--summary.--The following statements provide a concise description of traditional writings on financial structure during this period:

1. The transitional period is characterized by elaboration on the main concepts identified during the formative period of the traditional theory.

2. Many rules-of-thumb are provided as guideposts to the amount of leverage that the firm should employ, but these rules-of-thumb are not empirically tested.

3. Institutionally imposed debt limits are identified by writers as providing a constraint on the opportunity of the firm to incur fixed-charge financing.

4. The opinion continued to be predominant among theorists that a judicious use of debt financing would be cheaper for the firm than using an all-equity financial structure. In contrast to writings during the formative period, however, explicit statements are made relating higher common stock prices to a proper or wise use of leverage. Further, inferences are made that the firm's

common stock price would be penalized by the excessive use of leverage.

The formalization period

The period encompassing the 1950-1960 era, like the previously discussed transitional period, contains considerable elaboration on concepts that have been previously identified; however, an increasing number of financial theorists relate the concept of an optimum financial structure to the valuation of the firm. The attempt will now be made to understand the essence and significance of major writings during the formalization period and, in so doing, to illustrate how the traditional theory of the optimum financial structure became more rigidly defined in relation to the earlier periods, where comments were loosely offered by most writers on the subject.

It is difficult to separate investing decisions from financing decisions, as the decision to invest often carries with it the problem of raising the funds to finance the investment. This is evident in the 1951 classic authored by Friedrich and Vera Lutz, The Theory of Investment of the Firm (31), which contains several statements important to the development of the traditional theory. The Lutzs provide reinforcement for at least three cornerstones of what is generally thought of as the traditional theory. First,

the supply price of fixed-charge securities to the enterprise is a function of the degree to which the firm is already levered (31, pp. 167-168). Second, the dispersion of earnings before taxes experienced by the firm influences the degree to which the firm will lever itself (31, p. 202). Third, an optimum combination of sources of funds to the firm does exist (31, p. 204).

Up to this point, in the development and meaning of the traditional view on financial structure, few definite statements have been observed that state unequivocably that optimum financial structures are an objective of economic activity; this point will be expanded upon. The Lutzs provide such a statement:

> In choosing the method of financing an additional unit of investment the entrepreneur must be guided by the aim of maximizing the contribution made by that unit to the level of his own total net profit prospects. He will go on using any one source of funds in preference to another until the addition to his net profit prospects due to an additional unit of investment financed from that source is no greater than the addition to his net profit prospects due to an additional unit financed from an alternative source. He will reach the optimum combination of sources at a point where the addition to the net profit prospects from each source is the same, unless he does not have access to all sources, or there is a quantitative limit on the amount he can obtain from one or more of them. (31, p. 204)

In the above quote it should be noted that if the net profit prospects of the entrepreneur being discussed are

thought of as including the effect of the financing decisions on the value of the equity of the firm, then the statement is truly in the traditional spirit. Not only is an optimum combination of financing sources defined, but institutional rigidities that might operate to inhibit the optimum from being reached are mentioned.[20]

In 1952 Durand's highly important article, "Costs of Debt and Equity Funds for Business: Trends and Problems of Measurement" (12), appeared and had significant repercussions for the traditional theory. It is not intended to classify Durand as a member of the traditional school, but rather to offer his concepts as forming an integral part of this theory.[21]

Durand finds it impossible to separate the problem of measuring the cost of capital funds to the enterprise from the problem of placing a valuation on the enterprise itself. Security analysis and corporate financial theory are not distinct areas of knowledge but are closely intertwined. The theorist who hopes to find a definitive answer to the problems of measuring capital costs should be aware of Durand's following statement:

> We can measure the costs of capital about as accurately as we can measure the value of common stock, and any of us who think that stock appraisal is a form of crystal gazing should prepare to include research on the cost of capital in the same category. (12, p. 91)

It is not stretching the imagination to carry the basic thought of Durand's above statement to the difficulties of trying to ascertain whether or not optimum financial structures exist.

Durand began his analysis by assuming a different objective of financial management than did most theorists at the time his paper was published. Instead of assuming that the businessman has as his economic objective the maximization of net profits, the critical underlying assumption is that the businessman strives to maximize his wealth.[22] Wealth maximization has the distinct advantage from the standpoint of financial theory of taking into consideration the effect of investing and financing decisions on the value of the firm's equity.

Having established his position that security valuation and determining the cost of capital funds to the enterprise are inseparable problems, and adding the objective of wealth maximization, Durand then presented two methods of appraising the value of the firm. These two approaches to capitalizing earnings are labeled the net operating income method and the net income method (12, pp. 98-100). They represent polar positions in valuing the firm with respect to the degree of financial leverage.[23]

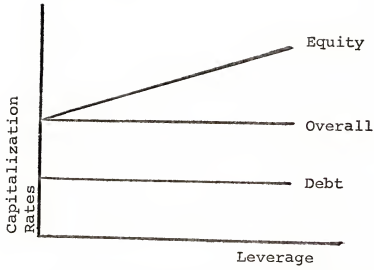
Consider first the situation where there is no corporate

income tax. Assume that a given firm has a financial structure containing only bonds and common stock and that the firm is levered to a degree deemed acceptable by the market. The basic assumption of the net operating income method of valuation is that the value of the firm, the sum total of the market values of its bonds and stocks, is arrived at by capitalizing net operating income. The value of the common stock is determined by subtracting the value of the debt from the value of the firm. Now, if the firm moves to a more heavily levered financial structure, according to the net operating income method of valuation, the total market value of the firm is unchanged. The essence of this approach to valuation, when taxes are not considered, is that the firm's financial structure is of no consequence to the value of the firm. The division between debt and equity is not important, so one financial structure is as acceptable as another. It could, therefore, be said that all financial structures are optimal. As the same capitalization rate is applied to net operating income, and as it is unaffected by the degree to which the firm is levered, the overall cost of capital funds to the firm is independent of the degree of leverage. With an overall cost of capital that is constant, as the firm uses more debt funds which carry a cost less than the overall rate, the implication is that the advantage

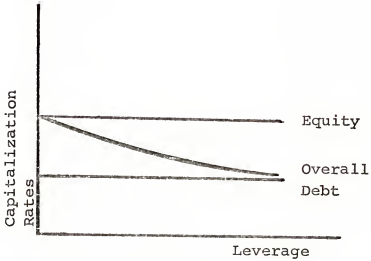
of cheaper debt funds is offset by a rising cost of equity over all degrees of leverage. This is illustrated in graphic form in Figure 1 (a).

The net income method of valuation proceeds in a different manner. The market value of the firm is arrived at by capitalizing net income, which gives the market value of the common stock, and adding to this the market value of the debt. In the net income approach the firm's financial structure is of extreme importance, as the value of the firm would increase with leverage. The critical assumption is that the cost of debt and the equity capitalization rate remain unchanged as leverage increases. As more low-cost debt is used in place of high-cost common stock, the overall cost of capital to the firm decreases. This is illustrated in Figure 1 (b).

As Durand (12, pp. 99, 102) points out, theorists who subscribe to the net income method of security valuation are not going to suggest that debt be substituted for equity indefinitely. The firm would find that an excessive use of leverage would result in both a rising cost of debt and a rising cost of equity. The overall cost of capital to the firm would then be increasing and the minimum point, representing the optimum financial structure, would have been passed.



(a) The Net Operating Income Approach



(b) The Net Income Approach

FIGURE 1: Leverage and Capitalization Rates

When corporate taxes with the tax deductibility of interest are permitted to enter the picture, the firm's financial structure is of importance according to each method of valuation. With the net operating income approach the claims of all security holders are capitalized, that is, net income plus the interest payments to the bondholders. Should the firm subject itself to an increased degree of leverage, the value of the firm would increase.

The net income approach is essentially the same as described when the situation assumed no taxes. All of consequence that results is that the income stream capitalized, net income, is smaller due to the payment of the corporate tax. The value of the firm would still increase with an increased degree of leverage. In comparison, however, the net income approach results in a higher market value than the net operating income approach, assuming the rate of capitalization used in each method exceeds the average rate of interest on the firm's debt.

Durand's contribution was substantial. He pointed out the necessity of considering the valuation of securities and the costs of capital funds within the same framework. He clearly identified two approaches to capitalizing earnings, the net operating income approach and the net income approach, and these terms have endured. It was shown how,

without the corporate income tax, these two methods of valuation result in opposing views on the importance of the financial structure of the firm. Further, he illustrated that, in a world with taxes, both valuation methods consider financing decisions to be of prime importance. The formalization of the traditional view on financial structure was given a great boost by the Durand discussion but, as will be pointed out later, so was the independence hypothesis.

That the formalization period ended with a rather well defined presentation of the traditional view can be shown by discussing the 1959 article by Schwartz (44). His objective was to demonstrate that there is an optimum financial structure for the firm, or that there is a narrow range of optimum financial structures. The essence of Schwartz's argument can be gleaned by reference to Figure 2. In Figure 2 the horizontal axis represents increasing dollar amounts of common equity capital. Financial risk is also implicitly recognized on the horizontal axis, for, as the amount of common equity capital increases, the degree of financial risk decreases. The vertical axis represents increasing rates of return on common equity. Curve T, concave to the origin, is the rate of return function. Curve T represents the rate of return on common equity which the firm can expect to earn for each specific amount of common equity capi-

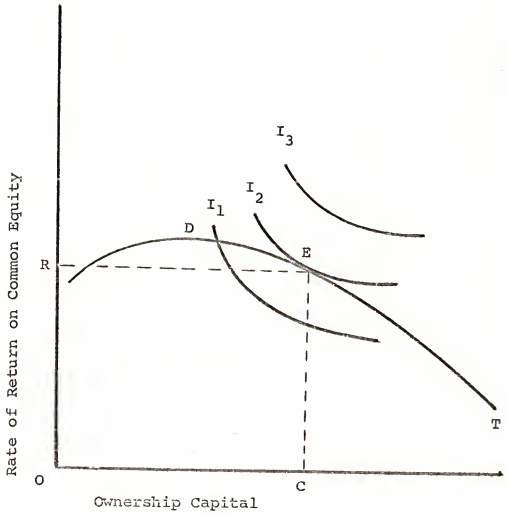


FIGURE 2:
Schwartz's Solution for the Optimum Financial Structure

tal employed. It must be pointed out that curve T does not represent the rate of return on total assets; therefore, curve T contains the effects of financial leverage. This rate of return function first rises as more ownership capital is employed, for in the range in which curve T is rising the firm is too heavily levered. The declining range of curve T reflects the effects of too little leverage and a declining marginal rate of earnings on assets as the asset level of the firm is increased. The point D, on curve T, indicates the maximum rate of return on common equity that the firm expects to earn based on the appropriate amount of ownership capital, the supply price of external funds that would be offered by the capital market to the firm at that level of ownership capital, and the declining marginal rate of return on assets. The firm, however, may not strive for the financial structure implied by dropping a perpendicular from point D to the horizontal axis. Rather, investor preference must be considered. The objective of financial management is taken by Schwartz to be the maximization of the market price of the firm's common stock. The wealth maximization assumption emphasized by Durand has been accepted. Investor indifference functions are indicated on Figure 2 by the curves I_1, I_2, and I_3. The investor indifference functions represent a choice between a higher

rate of return on equity capital at the expense of being exposed to greater degrees of financial leverage. The investor market will pay the most for this firm's common stock where the highest indifference function is tangent to the rate of return function. This is seen to be point E. The firm will, therefore, employ ownership capital to the amount of OC plus a given amount of external funds determined by a supply schedule of external funds, which has been omitted to simplify the analysis. The optimum financial structure is, therefore, determinate. The maximum market price for the firm's common stock will occur where the marginal rate of substitution between rate of return on common equity and risk in the firm's financial structure is equal to the marginal preference between rate of return on common equity and risk of investors in the market (44, p. 114). When the maximum stock price has been reached, the optimum financial structure has been designed by the firm's management in response to investor choice.

In discussing the heavily levered financial structures prevalent in the electric utility industry, Schwartz makes a comment which can be termed truly traditional in its content:

> . . . the shareholders are willing to shoulder the responsibility for a large volume of debt in exchange for a greater rate of return. In other words, the

> reaction of both borrowers and lenders of funds to the circumstance of low external risks brings about an optimum capital structure which is relatively heavily leveraged. (44, p. 115)

Schwartz, then, subscribes to the point of view that, within limits, the advantages of leverage are not completely offset by falling common stock price or a rising cost of equity. Further, he does not seem to hold the view that the only advantage of leverage is the tax advantage.

Schwartz added substance to the traditional view by providing a graphic analysis in the microeconomic spirit whereby, identifying a rate of return function and a market indifference curve, the optimum financial structure could be found.

While Schwartz's graphic analysis results in the identification of a single optimum financial structure for the firm, he did hold the view that there might be a range of optimum financial structures (44, p. 101). Other writers adhering to the traditional position have also argued that a range of optimum financial structures is the more likely situation confronting the firm. Weston, in fact, has explicitly stated that the overall cost of capital curve with respect to leverage probably has a horizontal portion over its center range. In a discussion relating to empirical testing of the independence hypothesis Weston described the

traditional view of the cost of capital curve as follows:

> If one follows the traditional argument, one could expect a weighted cost of capital curve which has a horizontal section over a relatively wide range. . . . When the two curves are combined [the cost of debt and the cost of equity], the resultant curve, which falls between the high cost of common-stock financing and the low-cost debt financing, exhibits a U-shape. It has a falling section and a rising section. But between the falling and rising sections there is a relatively broad range in which the curve is horizontal. (54, p. 158)

The traditional theory, then, while it has become formalized, can be expressed in diverse ways. The independence hypothesis still differs significantly from the traditional theory, whether it be stated as a single optimum financial structure or a range of optimum financial structures.

The optimum range argument is pertinent to this study. In Chapters IV and V statistical tests will be performed on the equity ratios of firms grouped according to specific criteria. The objective will be to ascertain whether the ranges of leverage used by firms in different groups differ in a significant manner.

Figure 3 depicts the optimum range variant of the traditional position. It is noticed that the overall cost of capital curve has a flat range over its center portion.[24]

Formalization period--summary.--Out of this era, refinements of the traditional theory occurred as follows:[25]

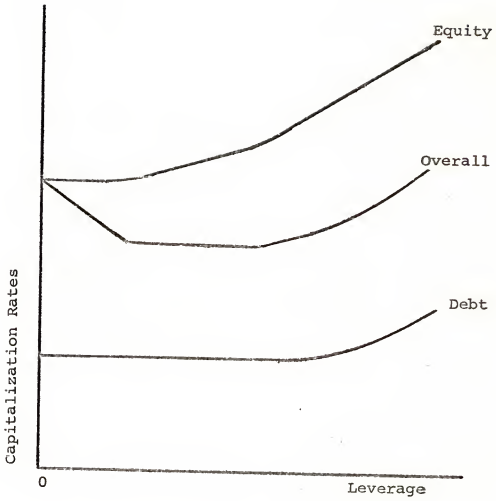


FIGURE 3: The Traditional View--Optimum Range Variant

1. The cost of funds to be borrowed in a given time period is a function of the degree to which the firm is already levered.

2. The theories of security valuation, determining the cost of capital to the firm, and determining the optimum financial structure are closely related.

3. Two methods of capitalizing earnings, the net operating income approach and the net income approach, represent opposing theories on the effect of leverage on the cost of capital funds to the firm and, therefore, whether or not the firm's financial structure is a major problem of financial management.

4. By assuming an investor indifference function, between the rate of return on common equity earned by the firm and the degree to which the firm is levered, and a rate of return function representing the rate of return the firm can expect to earn for each specific amount of equity capital employed, the concept of the optimum financial structure can be illustrated and shown to be determinate.

5. The traditional theory has its variations. Some posit that the cost of equity capital does not rise until after some critical leverage point, so the firm can lower its cost of capital by a significant amount as it first substitutes debt for equity. Others view the cost of capi-

tal curve as having a rather horizontal middle section. This would give a range of optimum financial structures and provides the so-called saucer-shaped cost of capital function with respect to leverage. The implication of this view is that over the relevant range additional increases in the degree to which the firm is levered have practically no effect on the cost of capital and the value of the firm.

The Independence Hypothesis: Development and Meaning

Introduction and Early Thoughts

The independence hypothesis is a direct challenge to the traditional theory of financial structure. The formal presentation of the independence hypothesis by Modigliani and Miller (36) threw the traditional concepts of the cost of capital and the value of the firm into turmoil (55, p. 163). As with most theories, however, an integrated presentation of the major hypothesis did not occur instantaneously. A gestatory period marked by important developments preceded the original Modigliani and Miller argument. These developments will now be discussed.

The work of J. B. Williams was discussed earlier in conjunction with the transitional period of development of the traditional theory. Perhaps one mark of a real classic is that it contains the germs of several secondary theories. Such is the case with Williams' The Theory of Investment

Value (60), for threads of the independence hypothesis are present in his volume. Williams clearly and explicitly identifies the situation where a change in the financial structure of the enterprise would not result in a change in the investment value of the firm as a whole (60, pp. 72-73). He even provides a tag for this phenomena, calling it "The Law of the Conservation of Investment Value." This predecessor of the Modigliani and Miller view writes:[26]

> If the investment value of an enterprise as a whole is by definition the present worth of all its future distributions to security holders, whether on interest or dividend account, then this value in no wise depends on what the company's capitalization is. . . . Furthermore, no change in the investment value of the enterprise as a whole would result from a change in its capitalization. (60, pp. 72-73)

Unlike a strict interpretation of the Modigliani and Miller hypothesis, yet to be explained in detail, Williams recognizes that market imperfections will very often allow the firm to benefit from changes in its method of financing its assets. The Law of the Conservation of Investment Value, therefore, is not thought to be important enough to relegate financing decisions to a position of secondary importance in the practice of financial management.

Further impetus to the independence hypothesis occurred in 1954. F. B. Allen presented some rather crude data on the financing behavior of 43 electrical operating utilities

(3).[27] Using average figures for the years 1947 and 1948, Allen constructed a series of scatter diagrams. Two of them are relevant to this discussion. In one diagram, Allen plotted on the vertical axis net income plus interest expressed as a percent of the market value of all securities for each firm. On the horizontal axis, he used as a measure of financial leverage the market value of debt and preferred stock expressed as a percent of the market value of all securities. Up to a leverage ratio of about 55-60 percent, Allen concluded that the return on market value of all securities was relatively constant (3, p. 58). Allen also concluded from his diagram that beyond a leverage ratio of about 55-60 percent the rate of return on market value would rise considerably.[28] It should be noted that the rising cost of capital curve (earnings after taxes to market value) identified by Allen is compatible with the traditional theory in the range beyond what is considered a reasonable use of leverage. Allen, however, found no evidence of a falling cost of capital curve, posited by the traditional theory, over lesser degrees of leverage.

The other diagram of interest supplied by Allen relates to an approximation of the cost of equity capital. On the vertical axis Allen plotted the average earnings-price ratio over the 2-year period for each of the 43 firms. The lever-

age measure used on the horizontal axis was the market value of debt and preferred stock expressed as a percent of the market value of all securities. Allen showed that the earnings yield increased markedly over increased degrees of financial leverage, implying that investors were aware of the risk of a heavily levered enterprise. Based on his empirical study, Allen reached this conclusion:

> From these analyses, it is evident that investors, as indicated by the market prices that their trading establishes, are fully aware of the added risk resulting from a higher proportion of senior capital, and fully discount this risk in the prices they pay. Therefore, there is, in fact, no real possibility of decreasing the "cost of capital" by going further into debt. (3, p. 60)

It is now logical to describe how the ideas of Williams and Allen, together with the net operating income method of capitalizing earnings put forth by Durand, were combined into a consistent theory relating financial leverage to the valuation of the enterprise.

The Modigliani and Miller Contribution

The heart of the controversial work of Modigliani and Miller is contained in their 1958 article, "The Cost of Capital, Corporation Finance and the Theory of Investment" (36). Modigliani and Miller provide justification for Durand's net operating income method of capitalization and Williams' Law of the Conservation of Investment Value by

adding a theory of investor behavior to the discussion. In order to clarify the discussion of their independence hypothesis, the following notation will be used:[29]

B = Market value of the firm's debt

S = Market value of the firm's common stock

V = Total market value of the firm's securities

O = Total income generated by the total asset investment of the firm

F = Total interest payments on debt

E = Earnings available for common stock

k_i = Average yield on debt securities

k_e = Yield on common stock

k_o = Average rate of return on the total market value of the firm's securities; also the weighted average cost of capital; all earnings and rates are before taxes

Given the above notation, these relationships are assumed to hold for the firm:

$V = B + S$

$O = F + E$

$k_i = F/B,\ F = Bk_i$

$k_e = E/S,\ E = Sk_e$

$k_o = O/V,\ O = Vk_o$

The assumptions behind the Modigliani and Miller model are important. The major ones are these:

1. Firms can be divided into equivalent return classes, also referred to as homogeneous risk classes. Firms in a given class are subject to the same degree of business risk, so the uncertainty of expected income generated by any firm's asset investment is the same as any other firm in the class.

2. Investors are in agreement as to the expected total income, O, to be generated by the firm's total asset investment.

3. Within a given class the market price of every share of stock is proportional to its expected return, k_e. The cost of equity capital, k_e, varies in proportion to the degree to which each firm in a class is levered.

4. The capital markets are perfect. Investors, both individual and institutional, act rationally and are not impeded by any legal or other type of rigidity in their economic behavior. This perfect state of the markets for securities also includes the condition that individual persons can borrow at the same rates of interest as corporations.

5. Initially, the model ignores the corporate income tax.

Within this framework, Modigliani and Miller advance two basic propositions for valuing securities of firms that have different degrees of leverage.

Proposition I

The market value of any firm is independent of its capital structure and is given by capitalizing its expected return at the rate, k_o, appropriate to its class (36, p. 98). In symbolic form and when the capital markets are in equilibrium, this can be stated as follows:

$$V = (B + S) = O/k_o$$

Proposition I can also be stated in an average cost of capital form. The average cost of capital to any firm is completely independent of its capital structure and is equal to the capitalization rate of a pure equity stream of its class (36, p. 99). In the adopted notation this appears as follows:

$$O/(B+S) = O/V = k_o$$

Modigliani and Miller, therefore, have accepted Durand's net operating income method of capitalizing earnings and arriving at the total investment value of the firm. They take the net operating income approach, however, and give it behavioral significance by relating it to investor behavior in the capital markets. Through a procedure loosely termed "arbitrage" by Modigliani and Miller, investors will take advantage of capital market disequilibrium (36, p. 99). Capital market disequilibrium is represented by the situation where k_o is not equal for firms in the same risk class.

Consider, for example, a situation where a levered firm has a higher total value than an unlevered firm of the same risk class. Through the arbitrage mechanism, an investor can take advantage of this situation by selling the overpriced firm's shares, borrowing on his personal account, and investing this combined sum in the shares of the underpriced firm. It can be shown that the investor will increase his return, if it is assumed he can borrow at the same rate of interest as the levered corporation.[30] With the capital markets and information perfect, this practice will be followed by numerous investors as long as there is a gain to be made. Such concentrated action will tend to equate the total value of each firm, thereby equating the cost of capital, k_o, for each firm.

Proposition II

The expected yield of a share of stock is equal to the appropriate capitalization rate, k_o, for a pure equity stream in the class, plus a premium related to financial risk equal to the debt-to-equity ratio times the spread between k_o and k_i (36, p. 101). In equation form Proposition II takes this appearance:

$$k_e = k_o + (k_o - k_i)\ B/S$$

The crux of Proposition II is that if the firm should finance with what on the surface appear to be cheaper debt

funds, the overall cost of capital, k_o, will still remain constant as hypothesized in Proposition I because the yield or cost of common stock will rise by an amount to offset exactly the use of the supposedly cheaper debt.

The Modigliani and Miller Propositions I and II can be graphically depicted by referring back to Figure 1 (a). The overall cost of capital curve corresponds to k_o and is horizontal over all ranges of leverage, which is what Proposition I asserts. Proposition II refers to the cost of equity, which has a positive slope in Figure 1 (a). More explicitly, the cost of equity curve has an intercept of k_o on the vertical axis and a slope equal to $(k_o - k_i)$. The slope of the cost of equity will be $(k_o - k_i)$ as long as the cost of debt is constant at the level indicated and would correspond to k_i in the present notation. The relationship between the Modigliani and Miller main propositions and the net operating income method of capitalization is therefore complete. Proposition I implies that one financial structure is as good as another, and Proposition II indicates how the use of cheaper debt capital is counteracted by a rising cost of equity funds. The cost of capital funds to the firm is independent of its financial structure. In its extreme form, therefore, where the tax deductibility of interest payments is not considered, the Modigliani and

Miller argument directly contradicts the traditional position on the importance of financial structure.

The complication of corporate income taxation

The Modigliani and Miller original article (36, pp. 102, 124) considered the reality of the corporate income tax but took the position that the shape of the yield functions identified in Propositions I and II would not be affected by this fact of economic life. The rates of capitalization are derived from the after-tax income available to the holders of securities, so the essential nature of the two propositions is not altered. By letting an asterisk (*) indicate that taxes have been considered and by letting t be the average and marginal corporate income tax rate, Propositions I and II can be adjusted for the effect of taxation.

The total income after taxes generated by the firm for all security holders becomes:

$$O^* = (O - Bk_i)\ (1-t) + Bk_i$$

Proposition I, therefore, takes this form:

$$O^*/V = k_o^*$$

Proposition II is adjusted to this:

$$k_e^* = (O - Bk_i)\ (1-t)/S = k_o^* + (k_o^* - k_i)\ B/S$$

Several studies have been constructed which empirically test tax-adjusted forms of Propositions I and II outlined above, and some of these will be briefly described in the

next chapter. Modigliani and Miller do maintain that k_o*, the after-tax capitalization rate, is independent of the degree of leverage employed by the firm but also state that k_o* cannot be properly referred to as the average cost of capital (36, p. 103). For empirical testing however, they continue to refer to k_o* as the average cost of capital (36, p. 112). This slight twist of terminology has been confusing to some of the best writers in the area of financial management and theory.[31] Actually, it is shown that the average cost of capital does depend on the degree of leverage which the firm chooses to employ. These major proponents of the independence hypothesis offer this statement on the subject:

> Thus, with a corporate income tax under which interest is a deductible expense, gains can accrue to stockholders from having debt in the capital structure, even when capital markets are perfect. The gains, however, are small, as can be seen. . . . (36, pp. 124-125)

The extension of the relation, however, turns out to be rather untenable. There is an implication that a firm could lower its cost of capital indefinitely with the use of increased leverage. The optimum financial structure would be the one with the maximum degree of leverage. In such a case, the overall cost of capital curve would have a negative slope over all degrees of leverage, as opposed to the

traditional view of a U-shaped cost of capital curve illustrated in Figure 3. Modigliani and Miller do recognize that there is a tax advantage associated with debt financing, and in their 1963 correction (37) of the original presentation (36) assert that the tax advantages of debt are even greater than they first hypothesized (in 1958). This is what has made empirical testing of the two differing positions on financial structure and the valuation of the firm extremely difficult. The difference between the independence position and the traditional position are from a statistical standpoint "small" and, therefore, far from easy to detect. From a theoretical standpoint, though, the differences are not "small" but are quite significant. Modigliani and Miller, even in their 1963 correction article (37, p. 634), hold that the only lasting advantages of debt financing are the tax advantages. This is far from the traditional view where, up to a loosely defined point, the wise use of debt will significantly lower the cost of capital, apart from the consideration of the corporate income tax. The proponents of the traditional view, therefore, hold that financing decisions are more important to the value of the firm than do the proponents of the (modified) independence hypothesis.

The independence hypothesis--summary

The essence of the independence hypothesis and its development follow:

1. The basic idea of the independence hypothesis is that the investment value of the firm does not depend on its capitalization. This view is found as early as 1938 in the writings of J. B. Williams. Because of institutional rigidities it was discarded by this theorist.

2. Durand's net operating income approach to valuation provided a formal framework within which the independence of the value of the firm from its financing could be analyzed.

3. An empirical study by Allen published in 1954 provided preliminary evidence that indicated the advantages of debt financing are not as great as traditional theorists assert.

4. Modigliani and Miller in their 1958 article gave behavioral justification to the net operating income approach to valuation.

5. Without the corporate income tax, the average cost of capital to the firm is not affected by the method of financing the firm's assets. If the cost of debt remains constant and debt is substituted for equity in the firm's financial structure, the cost of equity will rise by an amount to offset exactly the use of the supposedly cheaper debt capital. In this situation there is no such thing as an optimum financial structure, rather all financial structures are optimal. A form of investor arbitrage will maintain these relations.

6. When taxes are permitted to enter the framework, it is conceded that the tax deductibility of interest payments will lower the cost of capital funds to the firm. This is, however, the only advantage of debt financing.

Conclusion

This chapter has introduced the majority of terms to be used throughout the paper, has explored the development and meaning of the traditional view of financial structure, and has examined the development and meaning of the independence hypothesis and its implications for financial structure decisions. The traditional view has had a rather long period of gestation with the major elements of its theory having been identified in what was termed the formative period. It is no accident, however, that the formalization period of the traditional view coincides with the challenge thrown to it by the logically consistent theories of Modigliani and Miller. Whether agreement is reached with their position or not, it is the opinion of this writer that Modigliani and Miller provided a large part of the prod that has seen the field of finance move from the institutional presentations which characterized it until about 1955 to the analytical field which it is today.

Some empirical studies which resulted from the Modigliani and Miller attack on the traditional theory will be

examined in the next chapter, as will the methodology to be used in this study on the existence of optimum financial structures.

NOTES

[1]This method of differentiating between financial structure and capital structure is not followed by all writers. Weston and Brigham (59, p. 284) advocate the definition adopted here, but Schwartz (44, p. 101) uses the terms interchangeably to refer to the total of the right-hand side of the balance sheet.

[2]It is pointed out by Schwartz (44, p. 101) that in 1957 the General Electric Company reduced its current liabilities by issuing a debenture. In effect, working capital was financed through a long-term debt issue, thus illustrating a high degree of substitutability between current liabilities and long-term debt instruments.

[3]In the theory of the cost of capital, implicit cost refers usually to the situation where a financing decision causes investors to reappraise their expectations of the quality of the firm's earnings; thereby the price of this firm's common stock would be adversely affected. This view is concisely put forth by Solomon (47, p. 80) and Van Horne (51, p. 167).

[4]Other writers on the subject of the cost of capital have recognized the advantage of the Gordon definition. On this point see Johnson (25, p. 292).

[5]This composite discount rate is called in most texts on financial management the weighted-average cost of capital. Excellent descriptions of the calculating procedure for the weighted-average cost of capital can be found in Van Horne (51, pp. 109-134) and Weston and Brigham (59, pp. 340-360). Weston and Brigham (59, pp. 384-389) are among the few writers who emphasize the simultaneity of investing decisions and dividend decisions on the determination of the firm's cost of capital.

[6]The moment of triumph that the instructor of finance experiences after a careful exposition of the subject of financial leverage is amazingly similar to that experienced by the economics instructor describing the expansion of the money supply in a money and banking discussion.

[7]All standard finance textbooks provide clear expositions of the favorable and unfavorable effects of financial leverage from the standpoint of earnings available to the common stockholders or the rate of return on the common equity investment. Such presentations can be found in Guthmann and Dougall (22, pp. 167-169), Johnson (26, pp. 249-253), Friedland (15, pp. 165-169), Van Horne (51, pp. 554-558), and Weston and Brigham (59, pp. 285-292). As such examples are so numerous, it does not seem necessary to duplicate the effort here.

It should be mentioned that a considerable body of literature has been developed in recent years that deals only with the problems encountered in measuring financial leverage. Hunt (24, pp. 81-90) has advocated separate measurements for changes in the debt to equity proportions which would alter the rate of return on common equity, from changes in the level of earnings before interest and taxes that would change the rate of return on the common equity. Changes in the debt to equity proportions would be termed "trading on the equity," while fluctuations in earnings causing greater fluctuations in the rate of return on the common equity would be called "income statement leverage." Most writers, however, despite Hunt's plea, use the terms financial leverage and trading on the equity interchangeably. This is the case with Ivan R. Woods (63, pp. 525-534), who examines five measures of financial leverage.

In this work the terms discussed above will be used interchangeably.

[8]In this discussion risk and uncertainty are not used in the statistical sense, but rather interchangeably. In the area of statistical decision-making, risk is associated with a decision where the likelihood of a possible outcome occurring can be assigned a known probability. The case of uncertainty involves decisions where probabilities cannot be assigned to the possible outcomes or states of nature. The statistical usage is described by King (28, pp. 50-55).

[9]Solomon (47, p. 71) refers to the increased dispersion of earnings available to the common stockholders as a decrease in the quality of earnings available to this group of investors.

The coefficient of variation of earnings available to the common stockholders provides a measure of the dispersion of this stream of earnings. Van Horne (51, pp. 145-147) provides such a description.

[10]Net operating income is usually the focal point for a discussion of business risk, but for analysis purposes for most firms earnings before interest and taxes could be used due to the random nature of the distribution of what accountants call "other income."

[11]The belief that debt is cheaper than equity is a crucial point in both theories of financial structure that are to be discussed. Not all writers on the financing of corporations accept this view. More will be said on this subject as the major theories are discussed in detail.

[12]Barges (4, p. 6) refers to the Modigliani-Miller view as the independence hypothesis. This study shall use the terms "independence hypothesis" and "MM hypothesis" interchangeably.

[13]It must be emphasized that what is being developed in this section is the position of traditional business finance on the importance of financial structure. This is not a discussion of the development of traditional business finance, itself.

[14]This is the implication of the Modigliani-Miller Proposition II, which is yet to be discussed.

[15]An excellent work on debt limits or debt capacities is the book by Gordon Donaldson (10), or for a shorter version see his article (11).

[16]As this is not a study in the development of financial thought, the presentation of the traditional position will be accomplished by discussing only a few writers. The omission of contributions of a significant nature, therefore, will be noticed in all of the periods to be covered.

[17]In 1938 Lyon (33) came out with another text in the corporate finance area. He discusses the "proper" amounts of debt and equity capital (33, p. 301), provides yet more rules-of-thumb limiting the amount of debt issued (33, p. 314), and considers variations in revenue by industry as being an important factor limiting debt financing (33, pp. 301, 306, 314).

[18]Modigliani and Miller (36, p. 101) are able to find some strains of their theory in the work of Williams. This point will be covered in the discussion of the independence hypothesis.

[19]The presentation that Buchanan (5, pp. 298-312) makes on economic justification of corporate expansion is extremely well done, especially in relation to other business finance texts of the same era. The ideas presented in many recent articles on capital budgeting theory and applications are discussed by Buchanan.

[20]The interested reader might compare the statement of the Lutzs on the combination of optimum financing sources with that provided by Van Horne (51, p. 155) about 17 years later and note the similarity. The Lutzs certainly helped formalize the traditional view.

[21]Durand appears to lean slightly toward the independence hypothesis as it relates to the effect of financial structure on the valuation of the business unit (12, p. 115).

[22]While Durand provides an example of what is meant by the maximization of wealth, another extremely clear presentation of the concept in model form is given by Solomon (47, pp. 20-22).

[23]Numerical examples contrasting the net operating income and net income methods of valuation are prevalent in the literature of finance. Examples can be found in Solomon (47, pp. 81-84) and Van Horne (51, pp. 148-152). This discussion, therefore, will only briefly describe the major differences between these two valuation methods.

[24]Additional discussions relating to the view that a range of optimal leverage exists for the firm can be found in Solomon (47, pp. 96-98), Van Horne (51, pp. 155-156), and Weston (56, pp. 112-113).

[25]Other factors affecting the firm's financial structure in addition to those summarized below were emphasized by traditional writers during the formalization period. Waterman (53, pp. 38-39), for example, stressed the point that the liquidity of a firm's assets conditions its ability to incur financial risk.

[26]Williams has used the term capitalization, where the term capital structure would be used in this study.

[27]By the standards of the empirical research published today, Allen's data were rather rough, but the data were clear and his main point was directly made, which is something that cannot always be said of current empirical investigations. Allen also set a trend still often followed, that of using some species of utility firms to approximate the homogeneous risk class.

[28]Modigliani and Miller alter Allen's intepretation of his data by showing that the positive slope of their regression equation derived from Allen's data is not statistically significant (36, pp. 113-114).

[29]The symbols used by Modigliani and Miller are rather cumbersome with which to work, so the notation of Solomon (48) is employed. Other writers, such as Vickers (52), have proceeded in this manner.

[30]Examples of the arbitrage mechanism can be found in Solomon (47, pp. 100-101), Robichek and Myers (43, p. 25), and Van Horne (51, pp. 158-159).

[31]Weston and Brigham (58, p. 319) explicitly state that Modigliani and Miller in their 1958 article (36) hold that the cost of capital is not affected by the financial structure of the firm. Solomon (47, pp. 114-117) and Van Horne (51, p. 163) show that this is not quite the case.

CHAPTER III

PREVIOUS EMPIRICAL TESTING AND THE METHODOLOGY OF THIS STUDY

Introduction

To ascribe only a tax advantage to the use of debt financing, which is what the independence hypothesis does when taxes are admitted into the model, is quite a change from the traditional position on the importance of financial structure. While many theoretical and practical arguments can be offered in refutation of the Modigliani and Miller concepts, especially the arbitrage procedure and the shape of the equity cost curve under conditions of extreme leverage, the essence of the matter is best examined by empirical studies from which conclusions are drawn.[1] This chapter will look at some of the empirical studies that have been undertaken in the hope of casting light on the effect of financing decisions on the cost of capital funds to the firm and on the existence of observable optimum financial structures. Finally, justification for another study in this general area will be given, as will the methodology to be employed.

The Modigliani and Miller argument provoked a large number of empirical studies. In the following section of this paper only six of these are identified and discussed. They have been chosen in order to provide a clear picture of the nature of previous statistical work on this topic, while attempting to avoid undue redundancy. It will be seen that these studies still leave the major question of the importance of financing decisions open to debate.

In the discussion of the six works that follow, it will be noticed that five of them test directly for the effect of leverage on the cost of capital to the firm. The sixth study reviewed, that by Schwartz and Aronson (45), takes a surrogate approach in testing for the existence of optimum financial structures. This dissertation will likewise take a surrogate approach and thereby increase the evidence available from this type of procedure.

The idea for such an approach has been evident in the literature of financial management and theory. In the 1962 edition of their Corporate Financial Policy, Guthmann and Dougall write:

> Nevertheless, the adherence to similar financial standards by major companies in certain industries indicates that they may have hit upon an industry pattern of financing that represents a search for optimum capital structure. (22, p. 235)

Guthmann and Dougall have pointed out that the similarity in industry financing patterns is too prevalent to occur merely by chance. Solomon in his excellent and popular theoretical treatise has observed this same tendency:

> As far as those elements of instability and uncertainty are concerned, a firm is likely to resemble other firms in the same industry. But inter-industry differences are likely to be significant. Because of this, each industry group can be expected to have a different optimum range as far as leverage is concerned. This optimal range occurs at a higher level of leverage for stable industries than for unstable industries.
>
> One kind of evidence in favor of the traditional position is that companies in the various industry groups appear to use leverage as if there is some optimum range appropriate to each group. While significant inter-company differences in debt ratios exist within each industry the average usage of leverage by broad industry groups tends to follow a consistent pattern over time. (47, pp. 97-98)

The above statements by Guthmann and Dougall and Solomon imply that if significant differences could be shown to exist between the financial structures of a sample of firms classified by industry groups, then evidence in support of the traditional position would be provided. Therefore, such an approach is a surrogate or substitute for the direct method of testing for the effect of leverage on the cost of capital.

The underlying rationale for discussing the several empirical studies that follow is that the direct tests often provide contradictory results and that the surrogate approach

has not been employed enough to provide conclusive results. Within the frame of this rationale each specific study will be presented and the reason for its inclusion in this study stated.

Previous Studies[2]

Modigliani and Miller

The original article by Modigliani and Miller (36) contains empirical support for their tax-adjusted Propositions I and II. Electric utilities and oil firms are studied, but only the results of the electric utilities will be described. This utility study by Modigliani and Miller is the second of three closely related investigations on the topic of financial structure and the cost of capital. The sample of electric utilities studied by Modigliani and Miller is the same sample studied by Allen (3) and discussed earlier in this paper. In addition, the Modigliani and Miller 1958 electric utility study is the subject of a rejoinder by Weston (55) which will also be examined. The inclusion of all three of these studies provides a degree of continuity to the discussion. More important, however, the contradictory results that occur from direct tests of leverage on the cost of capital, using essentially the same data, are clearly illustrated by this group of articles. Allen, and Modigliani and Miller obtain essentially the same results,

while Weston does not agree with their findings. The Modigliani and Miller (36) tests will now be described.

In testing Proposition I, Modigliani and Miller seek to demonstrate that there is no significant relationship between the cost of capital funds to the firm and the degree of leverage employed by the same firm. In their empirical tests, Modigliani and Miller refer to the after-tax income available to security holders divided by the market value of the firm as the average cost of capital. This will continue to be referred to as k_o*. The test of Proposition I is to regress k_o* on a measure of leverage. The measure of leverage is the ratio of the market value of senior securities (debt plus preferred stock) to the market value of all securities, or B/V. Based upon the assumption, and this is a critical one, that firms operate within the acceptable debt range (where debt includes preferred stock), should the correlation coefficient be significantly negative, then support for the traditional view would exist. This would indicate that as the degree of leverage increases, the cost of capital decreases. On the other hand, should the correlation coefficient not be significant, then support for the independence hypothesis exists. This would indicate that increasing the degree of leverage employed by the firm has a negligible effect on the cost of capital for that firm.

For the sample of 43 electric utilities from which average figures for the years 1947 and 1948 were derived, the following regression equation was established (36, p. 113):

$$k_o^* = 5.3 + .006B/V \ (\pm .008)$$

$$r = .12$$

The correlation coefficient of .12 is not significant, and the direction of the sign of the leverage coefficient is positive, or counter to the traditional view under the assumption that the firm is operating within the acceptable range of leverage for its risk class. Modigliani and Miller, therefore, interpret these results as being evidence in support of their tax-adjusted Proposition I. It should be mentioned that Modigliani and Miller are quick to point out that the sign of the correlation is positive and opposite to that which traditional theory would posit, but when the correlation coefficient is not significant, neither can the sign be considered significant. Had the correlation coefficient been -.12 and not significant, but in the direction asserted by traditional theory, it is an open question as to whether or not these proponents of the independence hypothesis would have said the sign favored traditional theory.

A test of Proposition II is performed using data from

the same sample of 43 electric utilities. The approach in this case is to regress k_e*, the anticipated common stock yield, on B/S, the ratio of the market value of senior securities to the market value of common stock. Again assuming that the firms in the sample are levered within acceptable ranges, if the correlation coefficient should be in a positive direction and significant, the evidence would favor the tax-adjusted Proposition II, which asserts that in response to the added risk the yield on common stock will increase linearly with the degree of leverage. On the other hand, a correlation coefficient not significantly different from zero would favor the traditional view. The regression equation and correlation coefficient follow (36, p. 115):

$$k_e^* = 6.6 + .017\ B/S\ (\pm.004)$$

$$r = .53$$

The correlation coefficient of .53 is significant, and the slope of the regression equation of +.017 is in the direction postulated by Modigliani and Miller. They conclude that the evidence seems to favor their position on the shape of the equity yield function.[3]

Weston

In contrast to the results of the original Modigliani and Miller (36) empirical study on the leverage question, Weston (55) provides evidence in favor of the traditional

position. Like the major advocates of the independence hypothesis, Weston tests directly for the effect of leverage on the cost of capital. His method of investigation, however, differs in a significant manner from that of Modigliani and Miller, and in addition his article is a direct challenge to the conclusions drawn by Modigliani and Miller from their 1958 study. For these reasons, Weston's (55) study is worthy of consideration here.

Where Modigliani and Miller used simple regression analysis, Weston used multiple regression analysis. His sample consisted of 59 electric utilities with the data being for the year 1959. In his regression model Weston tests the hypothesis that the average cost of capital, k_o*, and the common stock yield, k_e*, are functions of not only leverage but also the size of the firm and the growth in earnings for that firm. He uses total assets (A) to represent firm size and a 10-year (1949-1959) compound growth rate in earnings per share to represent earnings growth (E). For the overall cost of capital, Weston's study produces the following regression equation (55, p. 170):

$$k_o^* = 5.91 - .0265\ B/V + 0.0A - .0822E$$

$$(\pm.0079)\quad (\pm.0001)\quad (\pm.0024)$$

$$R = .5268$$

It is now seen that the slope of the leverage variable

is negative and significant as put forth by the traditional view, and, further, the average cost of capital is found to be significantly correlated with growth in earnings in a negative direction. The multiple correlation coefficient R of .5268 is also statistically significant. Weston's results do not agree with the Modigliani and Miller position. This is further evidenced by his inquiry into the effect of leverage on common stock yields.

Weston's approach to testing the validity of Proposition II results in this regression equation (55, p. 170):

$$k_e^* = 6.75 - .0029\ B/V + 0.0A - .1352E$$

$$(\pm.0159)\quad (\pm.0002)\quad (\pm.0454)$$

$$R = .4032$$

The multiple correlation coefficient of .4032 is significant, and the coefficient for earnings growth of -.1352 is significant. The leverage variable, however, does not have a significant effect on common stock yield, the surrogate used for the cost of equity capital. Again, the results run counter to the theory offered by Modigliani and Miller.[4]

Weston's major contribution may have been something quite different than a mere challenge to another empirical study. He shows that leverage and growth are negatively correlated (55, pp. 190-171). Prior to this, Weston had

shown that growth in earnings per share lowers the average cost of capital and lowers equity yields. This is evident from the sign of the variable E in each of the regression equations previously discussed. He also has shown that the influence of growth outweighs the influence of leverage in each of his tests. An increase in leverage, in other words, could correspond to a decrease in earnings growth due to the negative correlation between these two variables. This would raise both the overall cost of capital and the cost of equity. The simple regression analysis performed by Modigliani and Miller in 1958 really measured leverage and growth with growth suppressed. Therefore, when Modigliani and Miller found the effect of increasing leverage on the cost of capital to be insignificant, this was due, according to Weston, to the negative correlation between leverage and growth, which in this case would offset the effect of leverage and cause the cost of capital to rise. A similar argument explains the Modigliani and Miller results for a rising cost of equity with increasing leverage. An increase in leverage occurs with a decrease in growth, which causes the cost of equity to rise. In conclusion, Weston has shown that there is a lot of "noise" in the capital markets, and because of this Modigliani and Miller may not have been measuring what they thought they were measuring.

Barges

Some aspects of the methodology of Barges' (4) study are especially important. Like the two previously described investigations, his study is a direct test of the Modigliani and Miller Propositions I and II and takes an industry approach to solving the problem of equivalent return classes. Unlike the previous studies, however, Barges uses curvilinear regression analysis as opposed to linear regression analysis. This allows him to test for the U-shaped cost of capital curve with respect to leverage. More importantly, from the standpoint of this dissertation, Barges presents an effective case for the use of book values in studying financial structures.[5]

The industries sampled are railroads, department store companies, and cement companies. As Barges does not construct a test of Proposition I for the department store sample or the cement company sample, only the implications of his railroad tests will be reported. Much like Weston, Barges' main contribution may be found in the theory of his study rather than in the actual empirical work.

Barges tests for the relationship between leverage and the average cost of capital in a manner different from either Weston or Modigliani and Miller. He fits a second-degree parabola by the method of least-squares to his rail-

road sample of 61 companies for the year of 1956. The general form of his curve is (4, p. 51):

$$k_o^* = a + b\ (B/V) + (B/V)^2$$

Unlike those before him, however, Barges uses book value figures for the leverage variable, B/V, as opposed to market value figures. The result of his method of testing Proposition I where I represents the index of correlation follows (4, p. 52):

$$k_o^* = 12.39 - .244\ (B/V) + .00258\ (B/V)^2$$

$$I = .665$$

Barges finds that his least-squares equation is significant, and, since he has fit a curvilinear relation to the data, he strongly concludes that the traditional hypothesis is upheld. The use of a second-degree parabola permits Barges to remove a very significant assumption that both Modigliani and Miller and Weston were forced to make, that is, that the firms being studied were operating within acceptable debt limits. Such an assumption permits inspection of the straight line regression equation for a negative sign with respect to the leverage coefficient. It is recalled that the traditional hypothesis concludes that the cost of capital function will turn upwards if the use of leverage becomes excessive. Without the critical assumption made by Modigliani and Miller and Weston, their tests of Proposition

I would be inconclusive, for a positive leverage coefficient would be compatible with the traditional hypothesis if the use of leverage was considered excessive. Barges removes this difficulty by fitting to the data a curve that closely resembles the traditional U-shaped cost of capital curve.

Barges finds that different approaches to the calculation of the leverage variable produce contradictory results in his study of the equity yield relationship. When leverage is measured by the ratio of debt to total equity, Barges finds this regression equation (4, p. 42):

$$k_e^* = 11.36 + .0194\ B/S$$

$$r = .173$$

Notice that the slope of the equation is positive, which favors the independence hypothesis, but the correlation coefficient of .173 is not significantly different from zero.

When Barges alters the leverage variable to include all senior securities, which is what Modigliani and Miller do, this regression equation is the result (4, p. 43):

$$k_e^* = 10.81 + .0239\ B/S$$

$$r = .293$$

The slope of the equation is not changed, but the correlation coefficient is now significant. Like the test of Proposition I, the leverage variable is measured by book values. The correlation coefficient of .293 for this test

of Proposition II is much less than the correlation coefficient of .53 that Modigliani and Miller found in their test of Proposition II on the electric utility sample. Still, this regression equation favors the independence hypothesis. Barges concludes in this case that the results of the equity yield relation are inconclusive.

The most significant by-product of the Barges investigation could be his argument in favor of using book values to represent the leverage variable in testing for the influence of leverage on capital costs. Besides noting what Modigliani and Miller themselves point out (36, p. 113, n. 38), that in the test of Proposition I the use of market value on either side of the regression equation could impart a positive bias to the results, Barges makes a stronger case for the use of book values. Consider this statement:

> To argue that changes in the market-value debt/equity ratios cause changes in the market yields, one would have to hold that: (1) the market-value debt/equity ratios are in fact used by investors (i.e., the ratios influence investor decisions); and (2) the use of the market value ratios is widespread. (4, p. 32)

Barges feels that neither of the above conditions is a fact of economic behavior to the extent that the use of market values is a better measure of financial risk than is the use of book values. Barges, in fact, presents a graphic demonstration of the inverse relation between the growth rate in

earnings and the average cost of capital, and indicates how the use of book values would provide a better measure of the extent to which the two firms in his example are levered (4, pp. 29-31). His position on the relation between growth and the cost of capital is compatible with that of Weston (55). Barges then offers three reasons for the use of book values in his study (4, p. 37): (1) heterogeneity in the data, such as differing growth rates in earnings, will not result in a systematic variation in the derived yields; (2) where market value ratios are not easily controlled by management, book value ratios are more readily altered by management decisions; and (3) in contrast to market value ratios, book value ratios are reported in most statistical investor services, so investors probably react more to a change in book value ratios than to a change in market value ratios as far as leverage measures are concerned.

The perception by Barges that the use of book values to formulate leverage measures in some approaches to the study of financial structures is an important contribution to the methodology of financial research.

Lambert

Lambert (29) investigates the effect of debt financing on the price-earnings ratio of the firm's common stock. His approach is direct, easily understood, and illustrative of

the difficulty of interpreting the empirical results of financial structure studies, especially those regressing the cost of capital or equity yields on a measure of leverage. The number of firms observed is in comparison with other studies rather large, and the time period longer than most, the 14 years between 1947-1960.

The statistical approach Lambert takes is to derive coefficients of linear correlation between the year-end percentage of debt to total capitalization at book value and the average annual price-earnings ratio for each firm over the 14-year period. His results tend to favor the theory that increases in debt are recognized by investors in common stocks as adding to the riskiness of expected returns, so the price-earnings ratio is penalized. Lambert finds that 68 percent of the correlation coefficients have a negative sign. This indicates that price-earnings ratios tended to decline as the percent of debt in the financial structure increased. This corresponds to a positive equity-yield relationship, similar in nature to the test of Proposition II performed by Modigliani and Miller, except Lambert uses a time-series analysis where Modigliani and Miller used cross-section analysis.

Of the negative correlation coefficients that Lambert calculates, however, only 38 percent are significantly dif-

ferent from zero. This seems to put Lambert's study of price-earnings ratios in the same category as Barges' study of equity-yields, where the results can only be termed inconclusive. By now it should be evident that inconclusive or ambiguous findings seem to be characteristic of the direct tests of Propositions I and II. Because of statistical difficulties in holding many variables constant, the sign of the leverage measure in the regression equation is often relied on to indicate the effect of financial structure.

Wippern

Wippern has provided evidence in favor of the traditional position with two financial structure studies (61, 62), both of which test directly for the effect of leverage on equity yields. His first study (61) covers 49 firms in 7 diverse industries. His second study (62) samples 50 firms in 7 industries, but he replaces the utility group in his first study with an oil group in the second investigation. Wippern (62, p. 621) tests Proposition II by means of multiple regression analysis, as did Weston (55). In this multiple regression analysis the independent variables are measures of leverage, growth, dividend payout, firm size, and an industry control variable.

Wippern's studies are mentioned here because of the

adjustment for business risk which he has incorporated directly into his leverage measure. This leverage measure is (61, p. 11):

$$i/\overline{E}-2s$$

Where:

i = The current level of fixed financing charges of the firm

$\overline{E}$ = The current cash flow net operating income per share, computed from a 10-year logarithmic regression on time

s = The standard error of the estimate of the log-time regression

In the denominator of the leverage measure, Wippern has used a measure of earnings variability as a surrogate for business risk. He has, in effect, indicated that measuring business risk is an extremely important consideration in the study of financial structures. Some writers prefer to approximate business risk by using industry classes, but Wippern has taken a more rigorous approach. This dissertation will take both approaches to approximating business risk, that is, an industry grouping of firms and an earnings variability grouping of firms. This will be discussed in detail when the methodology of this paper is presented.

Schwartz and Aronson

In the studies just described, all of the authors have tested Modigliani and Miller's Propositions I and II in a direct manner. This direct method involves regressing some measure of the firm's average cost of capital on a measure of leverage for a test of Proposition I and regressing some measure of the firm's cost of equity capital on a measure of leverage for a test of Proposition II. It has been shown that the evidence is contradictory. Because of the inconclusive nature of the evidence offered by the direct tests, it seems that another approach to testing for the existence of optimum financial structures would be welcomed. Schwartz and Aronson (45) have provided such a substitute or surrogate approach. It is recalled that the reasoning behind such a method has been given by Guthmann and Dougall (22) and Solomon (47). The Schwartz and Aronson (45) study, therefore, is considered important because: (1) the approach taken by these writers differs considerably from that of others who have written on the topic of optimum financial structure, and (2) the approach involves a statistical technique that tests for the existence of optimum financial structures among broad industry groups in contrast to regression approaches which test for the effect of some measure of leverage on valuation. The technique used by Schwartz

and Aronson will be suggested as the appropriate technique to be used in this dissertation, but the study will be on a larger scale and with significant modifications.

The portion of the Schwartz and Aronson study that is of particular interest here deals with the analysis of financial structures at given points in time, 1961 and 1928. Schwartz and Aronson test the hypothesis that financial structures do not vary significantly within an industry at a certain point in time but do vary significantly between industries at this same point in time. The statistical technique which Schwartz and Aronson use is the one-way analysis of variance, which employs the F-ratio or variance ratio test of statistical significance.[6] Schwartz and Aronson investigate the effect of one factor, industry, on the proportion of equity in a firm's financial structure as measured at book value. Significant results are obtained in their study, which encompasses 4 broad classifications of firms: (1) railroads, (2) electric and gas utilities, (3) mining, and (4) industrials. Three samples are taken by Schwartz and Aronson, with each sample consisting of 8 firms for each classification. For both 1961 and 1928, all samples produce significant F-ratios.[7]

The relationship of this evidence to the topic of optimum financial structures is clear. Over time, industries

have presumably developed optimum financial structures conditioned by the inherent business risk of the particular industry.[8]

Some Conclusions Drawn from the Cited Studies

Some common elements and some common problems run through the studies which have just been examined and permit these conclusions to be stated:

1. The major question is still unsettled. Evidence in support of both the traditional view of the effect of financial structure on the cost of capital and the existence of optimum financial structures, and of the independence hypothesis has been cited. Using Allen's (3) data, Modigliani and Miller (36) presented regression equations which can be interpreted in favor of their hypotheses. Lambert (29), in addition, found that in 68 percent of the cases examined the equity capitalization rate increased as the percent of debt in the firm's financial structure increased; this relates closely to the Modigliani and Miller position summarized in Proposition II. Other studies, notably those by Weston (55), Barges (4), Wippern (61, 62), and Schwartz and Aronson (45), reached conclusions favoring the traditional position.

2. A relationship between basic business risk and the financial structure of the enterprise exists. Practically

all studies at some point dwell upon this effect. Wippern thought the concept important enough to incorporate a measure of earnings variability (his business risk surrogate) directly into his leverage measure. Schwartz and Aronson based their entire study on the viewpoint that enterprises form their financial structures in relation to business risk as represented by broad industrial classifications.

3. The use of an industry as representing a homogeneous risk class is only grudgingly accepted. This is evidenced by the use of several industries in most empirical studies. Barges used 3 industries, Wippern used 7, and Schwartz and Aronson analyzed 4.

4. The use of regression equations in testing for the effect of leverage on the cost of capital and earnings yields is often inconclusive. In such studies because the effect of the leverage variable employed often turns out to be insignificant, the researcher resorts to an inspection of the sign of the independent variable to see if the effect on the dependent variable is in the direction hypothesized. This difficulty is evident in the works of Lambert and Barges. The study by Schwartz and Aronson, however, which does not depend on regression analysis for its conclusion, is not thwarted by ambiguity. This is because Schwartz and Aronson test only for the existence of a relationship or its

absence, using the one-way analysis of variance technique, which permits a test for qualitative differences between classes to take place.

The Substance and Method of This Investigation

Hypotheses

This dissertation investigates two hypotheses; one can be considered the major hypothesis and the other the minor hypothesis. Testing of the major hypothesis involves the bulk of the effort, and this will be done in two distinct manners. The acceptance or rejection of the minor hypothesis will be determined by the results of the second approach to testing the major hypothesis.

Major hypothesis

It is hypothesized that optimum financial structures exist. The statistical testing of this hypothesis will take these two forms:

1. Given a number of industry groups, the financial structures of firms in different industry groups are significantly different. A firm's financial structure for a given year will be represented by its common equity ratio calculated at book value.

2. Given a sample of firms classified by an earnings variability surrogate for business risk, the financial structures of firms in different variability classes are significantly different.

Minor hypothesis

It is hypothesized that a more meaningful approximation of a homogeneous business risk class can be established by a measure of earnings variability than by use of an industry classification.

Methodology

General

The major proposition is that optimum financial structures exist--they are a reality, an objective of rational economic activity, The method of research is deductive in that the general theory has been assumed and is to be verified by a thorough examination of the empirical data. This is an exercise in positive theory and not normative theory, although an extension of the major hypothesis to a normative framework would be a logical enlargement. If optimum financial structures exist, then economic enterprises should actively seek to find the optimum mixture of the financing sources available to them. The firm which has actively searched for and found the appropriate combination of debt and equity sources of funds will have secured its capital at the lowest possible cost, will have maximized the price of its common stock, and, thereby, will have maximized the wealth of its residual owners. The relationship of this study, therefore, to a normative theory is quite close.

The industry analysis

The testing for significant differences in financial structures between industry groups can be accomplished by using the one-way analysis of variance technique. If the variability of mean equity ratios between industry groups differs significantly from the variability of equity ratios within industry groups, then it can be concluded that optimum financial structures exist. This is the statistical approach used by Schwartz and Aronson (45). Four weaknesses in the Schwartz and Aronson study will be overcome in this study of financial structures:

1. Schwartz and Aronson test for significance in mean equity ratios between only 4 industries. Using their approach a stronger case could be made for the existence of optimum financial structures if a wider array of industry groupings were examined and significant results obtained. This study, therefore, will investigate the financial structures of 12 industries covering 77 firms.

2. The 4 broad classes of firms used by Schwartz and Aronson bias the results in favor of the traditional position. It is recalled that their original study is composed of a sample drawn from these areas: railroads, electric and gas utilities, mining, and industrials. The regulatory nature of the operations of utilities and railroads makes

detailed analysis of the financial structure of these classes, in comparison to a mining group and an industrial group, of doubtful significance. It is possible that the inclusion of railroads and electric and gas utilities makes the Schwartz and Aronson study a test of whether the financial structure of regulated industries differs significantly from that of unregulated industries. This entire question, then, should be re-examined, and that is one major part of this dissertation. This study will be concerned with 12 classes of firms, all of which would have been included in what Schwartz and Aronson very loosely call "industrials." In this manner it will provide one of the few empirical investigations not dependent on a regulated industry as an approximation of a homogeneous risk class. The previously described studies of Modigliani and Miller (36), Weston (55), Barges (4), and Wippern (61), all sample a utility group.[9]

3. Schwartz and Aronson test for significant differences in financial structures in only 2 years, 1961 and 1928. They imply later in their paper that significant differences have persisted over time, but present no statistical test of this assertion (45, pp. 422-426). It is hypothesized that stability in financial structure differences could be shown empirically by performing the one-way analy-

sis of variance on mean equity ratios for the selected sample for each year over a 10-year period. This will be done for the 12 selected industries over the period 1959-1968. In addition, inspection of the derived F-ratios will allow inferences to be made as to whether or not the differences in financial structures between classes of firms have increased or diminished over this 10-year time span.

4. The one-way analysis of variance that Schwartz and Aronson perform only indicates that the sample means are not all equal. It does not indicate whether or not all meaningful comparisons between industries are significantly different. For instance, the Schwartz and Aronson study does not indicate if the difference in mean equity ratios between utilities and railroads is significant. It only tells us that the differences between all 4 industry means are significant. A severe weakness exists, therefore, as the rejection of the null hypothesis could be attributed entirely to one industry, such as the utility group. Again, conclusions drawn in favor of the traditional stand on financial structure from such data are of uncertain value.

To overcome this weakness a pariwise test described by Yamane (64, pp. 690-694) will be employed to test for significant differences between mean equity ratios for all meaningful comparisons between industry groups. This test

is used if the one-way analysis of variance turns out significant, and has the additional benefit of using data derived from the analysis of variance procedure. This additional statistical inquiry will add substance to conclusions drawn from the analysis of variance if rejection of the null hypothesis occurs because of the financing behavior of more than one industry group.

Because of the four major approaches, described above, that this dissertation will take to overcome shortcomings present in the Schwartz and Aronson study, it is believed that a meaningful contribution to the empirical evidence on the question of the importance of financing decisions will be provided.

The earnings variability analysis

The second approach to testing for the existence of optimum financial structures will employ the one-way analysis of variance statistical technique but will alter the method of classifying firms. The first approach, described above, classifies firms by industries and tests for significant differences between the mean equity ratios of industry groups. This second approach will substitute an earnings variability measure for the industry classification.

Most empirical tests have depended on an industry classification as the pragmatic method of solving the homo-

geneous business risk class difficulty. It is suggested that an earnings variability surrogate for risk is more appropriate than an industry classification, as the industry classification is rapidly losing meaning due to the preponderance of multiple-product firms in our economy and the increasing move on the part of the United States industrial structure towards conglomeration. In addition, the development of the traditional view on financial structure discussed in Chapter II showed that as early as the formative period the variability of some type of earnings stream has been an important influence on the ability and likelihood of the firm to incur financial leverage.

By taking a measure of income per share over some time period and performing a logarithmic regression against time for each firm in the sample, a comparable measure of earnings variability which can be used as a surrogate for business risk can be derived. If the income data are not transformed into logarithmic form, a firm with a very favorable growth trend in income would exhibit wide variability in relation to a firm which has had rather constant earnings over the same period of investigation. Any bias, either for or against growth in income, is eliminated by the log-trend regression. This occurs because the standard error of the regression coefficient of the regression line will provide

a percentage variation around that line once the antilog of the standard error is found. The standard error of the regression coefficient of the log-trend line will be the measure of variability and hence the business risk surrogate used in this portion of the analysis.

Two income streams will be investigated. The objective is to find a measure of business risk, so a stream of income is desired which will reflect the earnings of the firm before it meets any of its financing charges. Financial literature has commonly used earnings before interest and taxes (EBIT) as the relevant income stream for this purpose.[10] EBIT per share will be one income stream used for the 77 firms in the sample. It is also thought that, as firms use several methods for depreciating assets, another income stream could be analyzed which would remove this effect from the data. Further, because depreciation is a major non-cash expense, a measure of income before depreciation and taxes might be just as relevant as EBIT in influencing the financing pattern of the firm. Hence, operating income before depreciation (OIBD) on a per share basis will also be used for the 77 firms in the sample. The relationship between OIBD and EBIT follows:

Operating income before depreciation (OIBD)

less: depreciation

plus: net of other income and expense

= Earnings before interest and taxes (EBIT)

Three time periods will be analyzed for each of the two income streams. These periods will be 1959-1968, 1959-1963, and 1964-1968. The log-trend analysis will be calculated for each of these time periods and for each income stream, permitting standard errors to be derived six different times for each firm in the sample. Thus, six one-way analyses of variance can be performed with the objective being to determine if the effect of earnings variability on the mean equity ratios of firms grouped into different risk (variability) classes is significantly different between classes. The groupings will be arbitrary and qualitative, such as high variability, medium variability, and low variability. It will then be possible to test if the variability within classes is significantly different from the variability between classes. A variability classification, then, is substituted for the industry classification described previously. The shorter time periods, 1959-1963 and 1964-1968, are utilized to permit extreme fluctuations in the income streams to have a meaningful effect on the variability classification. In these shorter periods there are 5 observations, as opposed to 10 observations in the 1959-1968 time span. The latter will therefore have, in general,

much smaller standard errors. One extreme fluctuation is mitigated over the 10 observations, but is not dampened as much over 5 observations. It is possible that in affecting financing decisions, an extremely good or bad year might influence the financing behavior of the firm. For this reason, the shorter periods are deemed relevant. In effect, management might just as well be influenced by what happened over the past 5 years as it is by what happened over the past 10 years.

Comparison of the results from the earnings variability classifications with the results from the industry analysis will either uphold or refute the minor hypothesis of this study. Should significant results be obtained from the earnings variability analysis and not from the industry analysis, then the minor hypothesis would be accepted. This would indicate that variability in the income streams studied has a greater effect on the use of leverage by the firm than does the industry in which the firm operates.

Summary

If financial structure is of little consequence as far as the value of the firm is concerned, then within any particular risk class the financial structures represented by common equity ratios should be randomly distributed, as should the financial structures between risk classes. Ap-

proximating the equivalent risk class by two methods, industry and earnings variability, will permit statistical tests of significance to be calculated on the equity ratios of the firms involved in the sample. This should provide unambiguous evidence as to the existence of optimum financial structures and, further, should provide evidence as to whether industry classes or earnings variability classes bear the closer relationship to financial structure decisions.

NOTES

[1]Arguments against the arbitrage mechanism are found in Solomon (47, pp. 102-103), Robichek and Myers (43, p. 26), and Van Horne (51, pp. 159-160). The downward shape of the equity cost curve is discussed in Solomon (48, pp. 175-181; 47, p. 110), and Van Horne (51, pp. 161-162).

[2]This section describes some of the contradictory findings that have resulted from empirical tests of the Modigliani and Miller Propositions I and II. Theoretical (as opposed to empirical) discussions of the importance of financial structure have been equally contradictory. For example, Stiglitz (50) contends the major implications of the Modigliani and Miller (36) partial equilibrium analysis can be shown to hold under the conditions of a general equilibrium model. Stiglitz also asserts that the major assumptions upon which the Modigliani and Miller model was built and later attacked by its critics can be relaxed without destroying the validity of the independence hypothesis. On the other hand, Mossin (39) indicates that the Modigliani and Miller assumptions are quite important, especially the risk class assumption.

In another theoretical argument more favorable to the traditional view than the work of either Stiglitz or Mossin, Vickers (52) holds that a firm can benefit from leverage by discriminating effectively against suppliers of capital funds. Schwartz (44) has likewise maintained that effective monopsonistic discrimination against the suppliers of funds can favorably affect the value of the firm.

[3]In a later and more sophisticated study (35) Modigliani and Miller still hold that the only influence of leverage on the value of the firm is through the tax benefit of debt. An excellent review of this 1966 study (35) is provided by Weston and Brigham (59, pp. 424-433).

[4]The careful reader will note that Weston cleverly uses B/V for the leverage measure in his test of Proposition II. Since Proposition II is mathematically derived from Propo-

sition I, the leverage variable should be B/S, which is what Modigliani and Miller used in their statistical test of Proposition II. That B/V should be used in statistical testing represents a belief (bias) held by Professor Weston that the Modigliani and Miller Proposition II can actually be shown to reinforce traditional theory (54, p. 156). Barges (4, pp. 12-14) disagrees rather strongly with Weston on this point.

[5]The equity ratios in Appendix B, which form a major portion of this dissertation, have been calculated at book value. Schwartz and Aronson (45) in a study yet to be described also use book value equity ratios, so this procedure is not unusual.

[6]Practically all statistics texts describe this particular tool in detail. Explanations of a superior nature describing the essence of the procedure and its application can be found in Edwards (13, pp. 104-156), Freund and Williams (14, pp. 384-389), Guenther (18, pp. 200-223), Peters and Summers (40, pp. 297-312), Spence et al. (49, pp. 147-173), and Yamane (64, pp. 642-711).

[7]In the following chapter under the heading, "The Statistical Procedure," the financial theory implication of significant results from the analysis of variance is discussed.

[8]Beginning on page 92 the difference between this dissertation and the Schwartz and Aronson (45) study are detailed.

[9]A recent discussion by Grunewald and Nemmers (17, p. 388) also exhibits dissatisfaction with this particular aspect of the Schwartz and Aronson study. Grunewald and Nemmers agree that different industrial groups have developed optimum financial structures, but the Schwartz and Aronson verification of this hypothesis is based on an analysis of "only four rather crude classes."

[10]Excellent examples of this preference can be seen in Hunt's lucid presentation (24) and Johnson's introductory discussion (26, pp. 249-255).

CHAPTER IV

EMPIRICAL FINDINGS: THE INDUSTRY ANALYSIS

Introduction

This chapter consists of an extensive investigation of the financial structures of a rather large sample of firms. The period covered is 1959-1968. The objective is to provide evidence on the question of the existence of optimum financial structures. This study is not a direct test of Modigliani and Miller's Propositions I and II. Such a direct test would have to show that the degree to which a firm is levered is related to its market value or its cost of capital. Instead, the surrogate approach, suggested by Schwartz and Aronson (45), will be employed.

There are two underlying assumptions to this surrogate approach. First, the financial structures of firms are influenced by the basic business risk to which the firms are exposed. Second, different degrees of business risk can be approximated by different industry groupings. These assumptions are not unusual in traditional writings on financial structure.

To refute the Modigliani and Miller independence hypothesis using the surrogate approach, it will be necessary to demonstrate that inter-industry financial structures are significantly different. If financial structure does not matter as Modigliani and Miller assert, then equity ratios should be found at all levels for an industry rather than clustering around a given level (30, p. 308). If financial structure is important, however, then, through trial and error or the method of successive approximation, firms in a given industry probably have found an optimum range of leverage. This optimum range should differ significantly between industry groups. Should such a relationship be shown to exist, then evidence in favor of the existence of optimum financial structures will have been presented.

The Sample

The industries chosen for inclusion in this study meet two criteria. First, it is hoped that the influence of regulatory agencies on financing decisions can be minimized, so utilities and railroads are not considered. Second, for the statistical testing to be meaningful and not just an exercise in calculating, it is necessary that the industries chosen cover a broad spectrum of business risk. The industries have been chosen on an a priori basis and not according to any measure of variability.[1] The principal aim

is to provide a heterogeneous sample. The following industries will be used:

1. Aircraft Manufacturing
2. Aluminum
3. Automotive Parts and Accessories
4. Chemicals
5. Heavy Construction and Supplies
6. Drugs and Medicines
7. Glass, Glassware, and Containers
8. Machinery
9. Mining
10. Paper, Lumber and Wood Products
11. Department and Variety Retail Stores
12. Steel and Iron

From the above 12 industries, 77 firms have been selected to make up the sample. The procedure was to use Moody's Industrial Manual of 1969 (38) and randomly select 20 firms from each of the above 12 industries. Taking this group of firms, the 77 were selected which had been analyzed in the Dominick and Dominick (9) statistical data service for 1969. The final sample of 77 firms is large enough to provide a high degree of statistical precision. Further, the financial data are all taken from the same source, ensuring consistency in the treatment of the basic accounting

information, a condition vital to this study.[2] The 77 firms used in this study are listed by industry in Appendix A.

The Statistical Procedure

For each firm in a given year the percent of common equity in the financial structure is calculated at book value. Arranging the firms by industry permits mean equity ratios to be derived for each of the 12 industries in the sample. With the data classified in this manner it is possible to test for significant differences in the mean equity ratios between industry groups. The one-way analysis of variance is the statistical test employed. The analysis of variance tests the null hypothesis, which asserts that the difference between the population means of the various industrial classes sampled is zero. If the variability of sample means between industry groups is significantly greater than the variability within industry groups, the null hypothesis is rejected. Such a rejection would indicate or infer that the differences in financial structures between the 12 industry groups does not occur by chance but is the result of rational financial management.

Empirical Findings

The Analysis of Variance of Equity Ratios

The results of the analysis of variance of the equity ratios of the sampled firms for each year during the period

1959-1968 are summarized in standard form in Tables 1-10.[3] With a sample size of 77 and with 12 industry classes, the F-ratio must be greater than 1.94 to be significant at the 5 percent level. For the F-ratio to be significant at the 1 percent level, it must be greater than 2.54 (64, p. 883).

As these tables indicate, the null hypothesis is rejected at both the 1 percent and 5 percent levels of significance in each of the 10 years tested. The resulting inference is that the financial structures of firms in the different industry classes investigated are significantly different. These findings reinforce the results of the Schwartz and Aronson (45) study described earlier.

The results are somewhat surprising in that in no case is the null hypothesis even close to being accepted at the 1 percent level. Thus, the chance of rejecting the null hypothesis when it is, in fact, true is less than 1 percent in each of the 10 years. As the null hypothesis is rejected in all 10 analysis of variance tests, it seems there can be little doubt that inter-industry financial structure differences are significant. The differences persist over time, indicating a conscious policy on the part of financial decision-makers to adjust the composition of their sources of funds to the business risk to which the firm is exposed. If this is not the case, then the variability of

TABLE 1

Common Equity Ratios--1968
Summary of the Analysis of Variance

Source of Variation	SS	df	MS	F
between groups	7765	11	705.9	15.69*
within groups	2927	65	45.0	
Total	10692	76		

*Reject null hypothesis at both 5 percent and 1 percent levels of significance

Source: Computed from data in Appendix B.

TABLE 2

Common Equity Ratios--1967
Summary of the Analysis of Variance

Source of Variation	SS	df	MS	F
between groups	9069	11	824.5	11.45*
within groups	4678	65	72.0	
Total	13747	76		

*Reject null hypothesis at both 5 percent and 1 percent levels of significance

Source: Computed from data in Appendix B.

TABLE 3

Common Equity Ratios--1966
Summary of the Analysis of Variance

Source of Variation	SS	df	MS	F
between groups	8211	11	746.5	9.26*
within groups	5239	65	80.6	
Total	13450	76		

*Reject null hypothesis at both 5 percent and 1 percent levels of significance

Source: Computed from data in Appendix B.

TABLE 4

Common Equity Ratios--1965
Summary of the Analysis of Variance

Source of Variation	SS	df	MS	F
between groups	7365	11	669.5	9.52*
within groups	4571	65	70.3	
Total	11936	76		

*Reject null hypothesis at both 5 percent and 1 percent levels of significance

Source: Computed from data in Appendix B.

TABLE 5

Common Equity Ratios--1964
Summary of the Analysis of Variance

Source of Variation	SS	df	MS	F
between groups	7308	11	664.4	11.11*
within groups	3889	65	59.8	
Total	11197	76		

*Reject null hypothesis at both 5 percent and 1 percent levels of significance

Source: Computed from data in Appendix B.

TABLE 6

Common Equity Ratios--1963
Summary of the Analysis of Variance

Source of Variation	SS	df	MS	F
between groups	8912	11	810.2	10.05*
within groups	5236	65	80.6	
Total	14148	76		

*Reject null hypothesis at both 5 percent and 1 percent levels of significance

Source: Computed from data in Appendix B.

TABLE 7

Common Equity Ratios--1962
Summary of the Analysis of Variance

Source of Variation	SS	df	MS	F
between groups	8615	11	783.2	8.21*
within groups	6202	65	95.4	
Total	14817	76		

*Reject null hypothesis at both 5 percent and 1 percent levels of significance

Source: Computed from data in Appendix B.

TABLE 8

Common Equity Ratios--1961
Summary of the Analysis of Variance

Source of Variation	SS	df	MS	F
between groups	8200	11	745.5	6.69*
within groups	7245	65	111.5	
Total	15445	76		

*Reject null hypothesis at both 5 percent and 1 percent levels of significance

Source: Computed from data in Appendix B.

TABLE 9

Common Equity Ratios--1960
Summary of the Analysis of Variance

Source of Variation	SS	df	MS	F
between groups	7512	11	682.9	5.39*
within groups	8244	65	126.8	
Total	15756	76		

*Reject null hypothesis at both 5 percent and 1 percent levels of significance

Source: Computed from data in Appendix B.

TABLE 10

Common Equity Ratios--1959
Summary of the Analysis of Variance

Source of Variation	SS	df	MS	F
between groups	8452	11	768.4	6.56*
within groups	7613	65	117.1	
Total	16065	76		

*Reject null hypothesis at both 5 percent and 1 percent levels of significance

Source: Computed from data in Appendix B.

equity ratios within industry classes would be too extreme to permit a significant F-ratio to result. It appears that the financial structures of firms in a given risk class do cluster around an optimum range of leverage. There are, of course, some wide differences within an industrial grouping, but in no case has this been enough to dampen the wide differences between industries.

Another aspect of the industry study can be seen by referring to the calculated F-ratios for each of the 10 years, summarized in Table 11.

TABLE 11

Industry Analysis: F-Ratios

Year	F-Ratio
1968	15.69
1967	11.45
1966	9.26
1965	9.52
1964	11.11
1963	10.05
1962	8.21
1961	6.69
1960	5.39
1959	6.56

While all 10 tests turned out to be significant at both the 1 percent and 5 percent levels, the F-ratios for the last 6 years, 1963-1968, are noticeably larger than the F-ratios for the first 4 years, 1959-1962. A larger F-ratio indicates, of course, greater relative variation between

classes than within classes. What is observed, then, from the sample data, is that the financial structure differences between the 12 industries under scrutiny have actually sharpened over the 10-year period. Schwartz and Aronson (45, p. 422, n. 7) report a similar finding in their study, when they compare the derived F-ratios for 1961 to those of 1928, and point out that the former are higher.

The F-ratio is the value of the mean square (MS) between groups divided by the mean square within groups. Thus:

$$F = MS_{bg}/MS_{wg}$$

The mean square is a measure of variability. The F-ratio can increase for two reasons: either the mean square between groups gets larger or the mean square within groups gets smaller. It is seen from Tables 1-10 that the increased distinction between financial structures is due to less variability within groups (MS_{wg}) rather than to greater variability between groups (MS_{bg}). In 1968 the mean square between groups is 705.9, while in 1959 it is 768.4. The mean square within groups in 1968 is 45.0, while in 1959 it is much higher at 117.1. This same general pattern is seen over the 10-year span; that is, the variation between groups has not changed as much as the variation within groups. While on the whole the inter-industry differences have be-

come more distinct, as represented by higher F-ratios, this has been due mainly to a reduction in the variability within given industry classes.

The implication for financial theory from this observed phenomenon could be that through trial and error firms seek their optimum financial structures. Over time, as the financial decision-makers observe the activities of other firms in the same industry in relation to their financing decisions, and observe the reaction of the capital markets to changes in their own and competitors' financial structures, it is possible to identify a mixture of financing sources appropriate for the particular risk class to which the firm belongs. This does not mean that the firm's financial structure has to remain constant; for as the business environment changes, the business risk to which the firm is exposed changes. With a change in business risk, some firms could recognize the implication of the change for its pattern of financing sooner than other firms, thus suggesting one explanation for deviations from the norm at any particular point in time.

The Pairwise Test

The analysis of variance test has shown that inter-industry financial structures are significantly different, and the differences have persisted and sharpened over the

10 years studied, but nothing has been said about the pervasiveness of the differences. The significant F-ratios calculated for each time period made it possible to reject the null hypothesis that all the equity ratios were taken from populations with the same mean. In fact, the high F-ratios calculated and shown in Tables 1-10 in relation to the levels needed for significance indicate that extreme differences exist in the mean equity ratios between the industries sampled. It must be realized, however, that a significant F-ratio in any given year does not indicate that each sample mean differs significantly from every other sample mean. It would be possible for a significant F-ratio to result if one industry had a mean equity ratio that differed by a very wide margin from the mean equity ratios of the other industries, even if the mean equity ratios of the other industries clustered around a common point.

In order to improve upon the previous data and analysis, a pariwise test (64, pp. 690-694) was performed. This test uses the results of the analysis of variance, provided the result is significant. As the results were significant in all 10 cases, the pariwise analysis was performed for each of the 10 years studied. This multiple comparison test makes it possible to see which industries have mean equity ratios that differ significantly from each other. Thus, it

will be possible to observe the depth of the inter-industry financial structure differences. The results of the tests of differences in sample means are presented in Tables 12-21.

With 12 industries there are 66 comparisons to be made between the calculated sample means In Tables 12-21 the differences between means that are marked with a single asterisk are significant at the 5 percent level only, while those marked with a double asterisk are significant at the 1 percent level. In Table 12, which represents the year 1968, it is seen, for example, that the difference between the mean equity ratio of the steel sample and the aircraft manufacturing sample is 26.9 percent. This is significant at the 1 percent level, which means it must also be significant at the 5 percent level. The steel industry mean equity ratio is designated as x_{12} in Tables 12-21, and that of the aircraft manufacturing industry as x_1. Referring to Appendix B, which gives the equity ratios for all firms in the sample for each year studied, as well as the mean equity ratios for each industry, the difference between x_{12} and x_1 for 1968 is derived as follows:

$$x_{12} = 64.8\%$$

$$x_1 = 37.9\%$$

$$x_{12} - x_1 = 26.9\%$$

All the differences in Tables 12-21 are derived in this manner.

TABLE 12

Industry Analysis
Test of Differences in Sample Means: 1968
(Percent)

Indust.	Air. x_j-x_1	Alum. x_j-x_2	Auto. x_j-x_3	Chem. x_j-x_4	Const. x_j-x_5	Drugs x_j-x_6	Glass x_j-x_7	Mach. x_j-x_8	Mining x_j-x_9	Paper x_j-x_{10}	Retail x_j-x_{11}
x_i											
x_{12}	26.9**	20.4**	16.3**	6.1	8.0	-2.9	2.8	9.4*	-14.0**	1.9	8.3*
x_{11}	18.6**	12.1**	8.0*	-2.2	-.3	-11.2**	-5.5	1.1	-22.3**	-6.4	---
x_{10}	25.0**	18.5**	14.4**	4.2	6.1	-4.8	.9	7.5*	-15.9**	---	
x_9	40.9**	34.4**	30.3**	20.1**	22.0**	11.1**	16.8**	23.4**	---		
x_8	17.5**	11.0*	6.9*	-3.3	-1.4	-12.3**	-6.6	---			
x_7	24.1**	17.6**	13.5**	3.3	5.2	-5.7	---				
x_6	29.8**	23.3**	19.2**	9.0**	10.9**	---					
x_5	18.9**	12.4**	8.3*	-1.9	---						
x_4	20.8**	14.3**	10.2**	---							
x_3	10.6**	4.1	---								
x_2	6.5	---									

Source: Computed from data in Appendix B.
**Significant at 1 percent level: 36 of 66 comparisons.
*Significant at 5 percent level only: 7 of remaining 30 comparisons.

TABLE 13

Industry Analysis
Test of Differences in Sample Means: 1967
(Percent)

Indust.	Air. x_j-x_1	Alum. x_j-x_2	Auto. x_j-x_3	Chem. x_j-x_4	Const. x_j-x_5	Drugs x_j-x_6	Glass x_j-x_7	Mach. x_j-x_8	Mining x_j-x_9	Paper x_j-x_{10}	Retail x_j-x_{11}
x_j											
x_{12}	29.3**	21.2**	11.9*	7.1	5.5	-2.0	4.4	6.8	-18.5**	.7	8.8
x_{11}	20.5**	12.4*	3.1	-1.7	-3.3	-10.8*	-4.4	-2.0	-27.3**	-8.1	---
x_{10}	28.6**	20.5**	11.2*	6.4	4.8	-2.7	3.7	6.1	-19.2**	---	
x_9	47.8**	39.7**	30.4**	25.6**	24.0**	16.5**	22.9**	25.3**	---		
x_8	22.5**	14.4**	5.1	.3	-1.3	-8.8*	-2.4	---			
x_7	24.9**	16.8**	7.5	2.7	1.1	-6.4	---				
x_6	31.3**	23.2**	13.9**	9.1*	7.5	---					
x_5	23.8**	15.7**	6.4	1.6	---						
x_4	22.2**	14.1**	4.8	---							
x_3	17.4**	9.3	---								
x_2	8.1	---									

Source: Computed from data in Appendix B.
**Significant at 1 percent level: 28 of 66 comparisons.
*Significant at 5 percent level only: 6 of remaining 38 comparisons.

TABLE 14

Industry Analysis
Test of Differences in Sample Means: 1966
(Percent)

Indust.	Air. x_j-x_1	Alum. x_j-x_2	Auto. x_j-x_3	Chem. x_j-x_4	Const. x_j-x_5	Drugs x_j-x_6	Glass x_j-x_7	Mach. x_j-x_8	Mining x_j-x_9	Paper x_j-x_{10}	Retail x_j-x_{11}
x_j											
x_{12}	28.1**	25.1**	13.7**	10.1	10.1	2.2	7.5	7.9	-14.8**	.7	11.7*
x_{11}	16.4**	13.4*	2.0	-1.6	-1.6	-9.5*	-4.2	-3.8	-26.5**	-11.0*	---
x_{10}	27.4**	24.4**	13.0**	9.4*	9.4	1.5	6.8	7.2	-15.5**	---	
x_9	42.9**	39.9**	28.5**	24.9**	24.9**	17.0**	22.3**	22.7**	---		
x_8	20.2**	17.2**	5.8	2.2	2.2	-5.7	-.4	---			
x_7	20.6**	17.6**	6.2	2.6	2.6	-5.3	---				
x_6	25.9**	22.9**	11.5*	7.9	7.9	---					
x_5	18.0**	15.0*	3.6	0.0	---						
x_4	18.0**	15.0**	3.6	---							
x_3	14.4**	11.4*	---								
x_2	3.0	---									

Source: Computed from data in Appendix B.
**Significant at 1 percent level: 28 of 66 comparisons.
*Significant at 5 percent level only: 8 of remaining 38 comparisons.

TABLE 15

Industry Analysis
Test of Differences in Sample Means: 1965
(Percent)

Indust.	Air. x_j-x_1	Alum. x_j-x_2	Auto. x_j-x_3	Chem. x_j-x_4	Const. x_j-x_5	Drugs x_j-x_6	Glass x_j-x_7	Mach. x_j-x_8	Mining x_j-x_9	Paper x_j-x_{10}	Retail x_j-x_{11}
x_j											
x_{12}	18.8**	23.1**	9.9*	5.7	7.4	-.7	-4.3	4.8	-16.7**	-5.5	9.8*
x_{11}	9.0	13.3*	.1	-4.1	-2.4	-10.5*	-14.1**	-5.0	-26.5**	-15.3**	---
x_{10}	24.3**	28.6**	15.4**	11.2*	12.9**	4.8	1.2	10.3*	-11.2*	---	
x_9	35.5**	39.8**	26.6**	22.4**	24.1**	16.0**	12.4*	21.5**	---		
x_8	14.0**	18.3**	5.1	.9	2.6	-5.5	-9.1	---			
x_7	23.1**	27.4**	14.2**	10.0	11.7*	3.6	---				
x_6	19.5**	23.8**	10.6*	6.4	8.1	---					
x_5	11.4	15.7**	2.5	-1.7	---						
x_4	13.1**	17.4**	4.2	---							
x_3	8.9	13.2*	---								
x_2	-4.3	---									

Source: Computed from data in Appendix B.
**Significant at 1 percent level: 27 of 66 comparisons.
*Significant at 5 percent level only: 11 of remaining 39 comparisons.

TABLE 16

Industry Analysis
Test of Differences in Sample Means: 1964
(Percent)

Indust.	Air. x_j-x_1	Alum. x_j-x_2	Auto. x_j-x_3	Chem. x_j-x_4	Const. x_j-x_5	Drugs x_j-x_6	Glass x_j-x_7	Mach. x_j-x_8	Mining x_j-x_9	Paper x_j-x_{10}	Retail x_j-x_{11}
x_j											
x_{12}	22.1**	23.7**	7.3	5.2	10.7*	.1	-2.5	4.4	-15.1**	-5.8	8.2
x_{11}	13.9**	15.5**	-.9	-3.0	2.5	-8.1*	-10.7*	-3.8	-23.3**	-14.0**	---
x_{10}	27.9**	29.5**	13.1**	11.0**	16.5**	5.9	3.3	10.2*	-9.3*	---	
x_9	37.2**	38.8**	22.4**	20.3**	25.8**	15.2**	12.6*	19.5**	---		
x_8	17.7**	19.3**	2.9	.8	6.3	-4.3	-6.9	---			
x_7	24.6**	26.2**	9.8*	7.7	13.2**	2.6	---				
x_6	22.0**	23.6**	7.2	5.1	10.6*	---					
x_5	11.4*	13.0*	-3.4	-5.5	---						
x_4	16.9**	18.5**	2.1	---							
x_3	14.8**	16.4**	---								
x_2	-1.6	---									

Source: Computed from data in Appendix B.
**Significant at 1 percent level: 30 of 66 comparisons.
*Significant at 5 percent level only: 10 of remaining 36 comparisons.

TABLE 17

Industry Analysis
Test of Differences in Sample Means: 1963
(Percent)

Indust.	Air. x_j-x_1	Alum. x_j-x_2	Auto. x_j-x_3	Chem. x_j-x_4	Const. x_j-x_5	Drugs x_j-x_6	Glass x_j-x_7	Mach. x_j-x_8	Mining x_j-x_9	Paper x_j-x_{10}	Retail x_j-x_{11}
x_j											
x_{12}	28.5**	24.4**	7.9	4.4	7.6	1.8	-.4	4.7	-16.0**	-6.4	10.3*
x_{11}	18.2**	14.1*	-2.4	-5.9	-2.7	-8.5	-10.7	-5.6	-26.3**	-16.7**	---
x_{10}	34.9**	30.8**	14.3**	10.8*	14.0**	8.2	6.0	11.1*	-9.6*	---	
x_9	44.5**	40.4**	23.9**	20.4**	23.6**	17.8**	15.6**	20.7**	---		
x_8	23.8**	19.7**	3.2	-.3	2.9	-2.9	-5.1	---			
x_7	28.9**	24.8**	8.3	4.8	8.0	2.2	---				
x_6	26.7**	22.6**	6.1	2.6	5.8	---					
x_5	20.9**	16.8**	.3	-3.2	---						
x_4	24.1**	20.0**	3.5	---							
x_3	20.6**	16.5**	---								
x_2	4.1	---									

Source: Computed from data in Appendix B.
**Significant at 1 percent level: 30 of 66 comparisons.
*Significant at 5 percent level only: 5 of remaining 36 comparisons.

TABLE 18

Industry Analysis
Test of Differences in Sample Means: 1962
(Percent)

Indust.	Air. x_j-x_1	Alum. x_j-x_2	Auto. x_j-x_3	Chem. x_j-x_4	Const. x_j-x_5	Drugs x_j-x_6	Glass x_j-x_7	Mach. x_j-x_8	Mining x_j-x_9	Paper x_j-x_{10}	Retail x_j-x_{11}
x_j											
x_{12}	29.5**	23.8**	7.3	6.7	6.1	2.5	-1.9	4.7	-15.6**	-5.3	8.1
x_{11}	21.4**	15.7*	-.8	-1.4	-2.0	-5.6	-10.0	-3.4	-23.7**	-13.4**	---
x_{10}	34.8**	29.1**	12.6*	12.0*	11.4*	7.8	3.4	10.0	-10.3	---	
x_9	45.1**	39.4**	22.9**	22.3**	21.7**	18.1**	13.7*	20.3**	---		
x_8	24.8**	19.1**	2.6	2.0	1.4	-2.2	-6.6	---			
x_7	31.4**	25.7**	9.2	8.6	8.0	4.4	---				
x_6	27.0**	21.3**	4.8	4.2	3.6	---					
x_5	23.4**	17.7**	1.2	.6	---						
x_4	22.8**	17.1**	.6	---							
x_3	22.2**	16.5**	---								
x_2	5.7	---									

Source: Computed from data in Appendix B.
**Significant at 1 percent level: 27 of 66 comparisons.
*Significant at 5 percent level only: 5 of remaining 39 comparisons.

TABLE 19

Industry Analysis
Test of Differences in Sample Means: 1961
(Percent)

Indust.	Air. x_j-x_1	Alum. x_j-x_2	Auto. x_j-x_3	Chem. x_j-x_4	Const. x_j-x_5	Drugs x_j-x_6	Glass x_j-x_7	Mach. x_j-x_8	Mining x_j-x_9	Paper x_j-x_{10}	Retail x_j-x_{11}
x_j											
x_{12}	25.3**	22.9**	2.7	4.3	3.6	-.9	-2.8	.7	-17.8**	-6.8	6.9
x_{11}	18.4**	16.0*	-4.2	-2.6	-3.3	-7.8	-9.7	-6.2	-24.7**	-13.7*	---
x_{10}	32.1**	29.7**	9.5	11.1*	10.4	5.9	4.0	7.5	-11.0	---	
x_9	43.1**	40.7**	20.5**	22.1**	21.4**	16.9**	15.0*	18.5**	---		
x_8	24.6**	22.2**	2.0	3.6	2.9	-1.6	-3.5	---			
x_7	28.1**	25.7**	5.5	7.1	6.4	1.9	---				
x_6	26.2**	23.8**	3.6	5.2	4.5	---					
x_5	21.7**	19.3**	-.9	.7	---						
x_4	21.0**	18.6**	-1.6	---							
x_3	22.6**	20.2**	---								
x_2	2.4	---									

Source: Computed from data in Appendix B.
**Significant at 1 percent level: 26 of 66 comparisons.
*Significant at 5 percent level only: 4 of remaining 40 comparisons.

TABLE 20

Industry Analysis
Test of Differences in Sample Means: 1960
(Percent)

Indust.	Air. x_j-x_1	Alum. x_j-x_2	Auto. x_j-x_3	Chem. x_j-x_4	Const. x_j-x_5	Drugs x_j-x_6	Glass x_j-x_7	Mach. x_j-x_8	Mining x_j-x_9	Paper x_j-x_{10}	Retail x_j-x_{11}
x_j											
x_{12}	23.7**	23.4**	5.1	4.3	5.6	-.7	-1.8	-2.1	-17.0*	-4.9	4.3
x_{11}	19.4**	19.1**	.8	0.0	1.3	-5.0	6.1	-6.4	-21.3**	-9.2	---
x_{10}	28.6**	28.3**	10.0	9.2	10.5	4.2	3.1	2.8	-12.1*	---	
x_9	40.7**	40.4**	22.1**	21.3**	22.6**	16.3**	15.2*	14.9*	---		
x_8	25.8**	25.5**	7.2	6.4	7.7	1.4	.3	---			
x_7	25.5**	25.2**	6.9	6.1	7.4	1.1	---				
x_6	24.4**	24.1**	5.8	5.0	6.3	---					
x_5	18.1**	17.8*	-.5	-1.3	---						
x_4	19.4**	19.1**	.8	---							
x_3	18.6**	18.3**	---								
x_2	.3	---									

Source: Computed from data in Appendix B.
**Significant at 1 percent level: 24 of 66 comparisons.
*Significant at 5 percent level only: 5 of remaining 42 comparisons.

TABLE 21

Industry Analysis
Test of Differences in Sample Means: 1959
(Percent)

Indust.	Air. x_j-x_1	Alum. x_j-x_2	Auto. x_j-x_3	Chem. x_j-x_4	Const. x_j-x_5	Drugs x_j-x_6	Glass x_j-x_7	Mach. x_j-x_8	Mining x_j-x_9	Paper x_j-x_{10}	Retail x_j-x_{11}
x_j											
x_{12}	27.8**	24.7**	8.9	4.7	1.5	1.1	.9	-1.7	-16.4*	-2.7	6.5
x_{11}	21.3**	18.2**	2.4	-1.8	-5.0	-5.4	-5.6	-8.2	-22.9**	-9.2	---
x_{10}	30.5**	27.4**	11.6*	7.4	4.2	3.8	3.6	1.0	-13.7*	---	
x_9	44.2**	41.1**	25.3**	21.1**	17.9**	17.5**	17.3*	14.7*	---		
x_8	29.5**	26.4**	10.6	6.4	3.2	2.8	2.6	---			
x_7	26.9**	23.8**	8.0	3.8	.6	.2	---				
x_6	26.7**	23.6**	7.8	3.6	.4	---					
x_5	26.3**	23.2**	7.4	3.2	---						
x_4	23.1**	20.0**	4.2	---							
x_3	18.9**	15.8*	---								
x_2	3.1	---									

Source: Computed from data in Appendix B.
**Significant at 1 percent level: 24 of 66 comparisons.
*Significant at 5 percent level only: 6 of remaining 42 comparisons.

The tests of differences in sample means show that at the 1 percent level of statistical significance the lowest number of comparisons turning out to be significant in any year is 24 out of a total of 66 comparisons. This low of 24 significant comparisons at the 1 percent level occurred in 1959 and 1960. At the 1 percent level, the greatest number of the 66 comparisons that are significant is 36. This occurred in the last year tested, 1968.

The greatest number of significant comparisons at the 5 percent level occurred in 1968, with 43 differences of the possible 66 indicating that the null hypothesis should be rejected. The lowest number of significant comparisons at the 5 percent level occurred in 1960 with 29 differences indicating rejection of the null hypothesis.

These results from the pariwise test add weight to the conclusion drawn from the analysis of variance performed on the mean equity ratios and summarized in Tables 1-10. The rejection of the null hypothesis in the analysis of variance procedure is not due to a single industry. The differences in financial structures are quite pervasive throughout the 12 industries being investigated. In fact, in 1968 at the 5 percent level 65.2 percent of the differences tested are significant.

A close look at Tables 12-21, however, will reveal that

3 industries account for most of the significant differences. These are aircraft manufacturing and aluminum, with rather low equity ratios, and mining, with rather high equity ratios. By taking some of the data derived in Tables 12-21 and presenting it in slightly different form, again it can be shown that, over the 1959-1968 time period, the financial structures of the industries and firms being sampled have become more distinct.

TABLE 22

Summary of Significant Differences in Sample Means at the 5 Percent Level

Year	Number of Significant Differences	Due to Three Industries	Percentage
1968	43	28	65.1
1967	34	28	82.4
1966	36	26	72.2
1965	38	26	68.4
1964	40	29	72.5
1963	35	29	82.9
1962	32	28	87.5
1961	30	28	93.3
1960	29	29	100.0
1959	30	29	96.7

Source: Computed from data in Tables 12-21.

Table 22 shows that in 1960, for instance, of the 29 sample mean differences significant at the 5 percent level, all 29 had the mean equity ratio from either the aircraft

manufacturing industry, the aluminum industry, or the mining industry as one of the two means being compared. In 1968, however, of the 43 significant differences, 28 were from these 3 industries, but this represents 65.1 percent of the significant comparisons, as opposed to 100.0 percent in 1960. There does seem to be a general tendency for the inter-industry financial structures to sharpen over time for this sample of 77 firms.

It must be realized in this pariwise test that, of the 66 possible comparisons, 30 will always involve one of the 3 industries that have exhibited extreme high or low equity ratios. For the most part these comparisons turn out significant, ranging from 26 to 29, as is seen in the third column of Table 22. The other 9 industries are more homogeneous, as represented by their mean equity ratios, but as column two of Table 22 indicates, this homogeneity appears to be decreasing.

Conclusion

This chapter has been concerned with the testing of inter-industry differences in financial structures as represented by common equity ratios. The sample consisted of 77 firms, covering 12 diverse industries, with the time period of investigation being 1959-1968. The main statistical procedure has been the one-way analysis of variance supple-

mented by a pariwise test for significant differences in the sample means of the 12 industries.

The major pattern for this study has been the Schwartz and Aronson (45) study of financial structures, which used the same statistical procedure. As was indicated in Chapter III, this study varies in four substantial ways from the 1967 Schwartz and Aronson inquiry. Instead of 4 industries, this study covers 12. Railroads and utilities are omitted, so the effect of industry regulation on financial structures is minimal. Where Schwartz and Aronson test only 2 years, this study tests 10 years. Further, the pariwise test performed, which utilizes the results of the analysis of variance, gives an indication as to the depth of the inter-industry financial structure differences.

In relation to the question of optimum financial structures, the results seem to be clear. The analysis of variance on industry mean equity ratios turns out to be significant for each of the 10 years in this study. In addition, the derived F-ratios, which measure the variability of mean equity ratios between industries in relation to the variability of sample equity ratios within industries, are all significant at the 1 percent level by a wide margin. The inference is that the differences in equity ratios between industries do not occur by chance. If the differences

do not occur by chance, then they must be due to rational financing decisions on the part of the firms' financial decision-makers. Firms appear to seek the best combination of debt and equity sources of funds tempered by the industry in which they operate. The evidence points to the existence of optimum financial structures. In addition, the industry does seem to have validity as an approximation of the homogeneous risk class, because of the consistent significance of the analysis of variance test over the 10 periods examined.

NOTES

[1]This is not an unusual procedure in financial structure studies. The same method has essentially been used by Barges (4, pp. 37-39) and Wippern (61, pp. 51-52).

[2]In relation to the precision of the sample, it can be noted that increasing the sample size from 77 to 212 would only result in a reduction of the F-ratio needed for significance at the 5 percent level from 1.94 to 1.83. In addition, selecting the sample in order to maximize the information available from a reputable data service is not without precedent. On this point see Wippern (61, pp. 51-52). What is needed are reliable, unbiased data, and it is believed the sample in this study meets these needs.

[3]Most statistical texts use a common series of abbreviations to summarize the results of the analysis of variance. A clear presentation can be found in Spence, et al. (49). The abbreviations used in the standard analysis of variance table are: SS for sum of squares, df for degrees of freedom, MS for mean square, and F for the calculated F-ratio.

CHAPTER V

EMPIRICAL FINDINGS: THE EARNINGS VARIABILITY ANALYSIS

Introduction

In Chapter IV the major hypothesis, that optimum financial structures exist, was upheld by testing for significant differences between mean equity ratios of 12 industries. The results were highly significant in each of the 10 years tested.

The objective of this chapter is to test for significant differences in financial structures among a sample of firms classified by a measure of earnings variability. In contrast to the analysis that was described in the previous chapter, the approach here will be to drop the industry approximation of the equivalent risk class and use an earnings variability measure instead. The same sample of 77 firms used for the industry analysis in Chapter IV will be used for the earnings variability analysis.

The Statistical Procedure

The method employed begins with constructing earnings variability risk classes. With the firms grouped by a meas-

ure of earnings variability, the inter-group equity ratios of these firms can be tested for significant differences. The analysis of variance procedure is used to ascertain whether or not the equity ratios between groups are significantly different.

Earnings variability is measured by two income streams. These are earnings before interest and taxes (EBIT) and operating income before depreciation (OIBD). The relation between these two measures of income was discussed in Chapter III. A logarithmic regression against time is performed on each of these income streams on a per share basis for the following time periods:

1. 1959-1968
2. 1964-1968
3. 1959-1963

The 462 regression equations thus derived provide a least-squares growth rate for each firm and a measure of variation around that growth rate. The variability measure is the antilog of the standard error of the regression coefficient. This antilog is the percentage variation around the growth trend, and is used as the variability measure in this study. Appendix C contains the variability measures for each firm.

By arraying the variability measures from lowest to

highest and arbitrarily classifying the firms into what appear to be rather natural divisions, risk classes are constructed. Tables 23 and 24, which follow, show these earnings variability risk classes for each income stream being studied, the number of firms which fall into each class, and the mean equity ratio of each class computed for the last year of the trend period. The ranges are shown as being discontinuous, for they are based on actual divisions as opposed to hypothetical dividing lines. It should be noted that the measures of variability for each earnings stream for the period 1964-1968 have been clustered into four classes. This is because a fifth division is not naturally observable for the 1964-1968 period. In the other periods, five classes are observed.

Financial theory holds that firms with high variability in earnings should use leverage to lesser degrees than firms with low variability in earnings. In Tables 23 and 24 risk classes are constructed six different times, that is, three for each income stream analyzed. Surprisingly, in five of these six cases the mean equity ratio of the high variability class is less than the mean equity ratio of the low variability class. It would seem that greater business risk, represented by greater variability, would be reflected in higher equity ratios to minimize financial risk. On the surface such a result is not observed.

TABLE 23

EBIT
Earnings Variability Risk Classes

Range of Variability for Each Risk Class	Observations	Mean Equity Ratio for Each Risk Class
1959-1968		
.35 - 1.02	12	62.8
1.08 - 1.69	24	60.2
1.82 - 2.79	21	57.6
2.91 - 3.81	12	54.7
5.19 - 11.76	8	55.7
1964-1968		
.32 - 1.99	13	61.9
2.04 - 3.92	27	56.9
4.09 - 5.84	20	60.1
6.15 - 37.68	17	56.8
1959-1963		
.36 - 1.00	9	71.1
1.27 - 2.40	17	69.1
2.61 - 4.66	22	67.1
5.02 - 6.88	10	62.8
7.31 - 52.89	19	59.8

Source: Derived from data in Appendix B and Appendix C.

TABLE 24

OIBD
Earnings Variability Risk Classes

Range of Variability for Each Risk Class	Observations	Mean Equity Ratio for Each Risk Class
1959-1968		
.35 - .87	14	62.8
.96 - 1.27	20	59.2
1.38 - 1.95	11	58.7
2.02 - 2.99	22	55.5
3.25 - 7.09	10	57.9
1964-1968		
.36 - 1.89	21	60.5
2.00 - 3.61	28	55.9
3.95 - 5.78	14	59.0
6.05 - 35.29	14	60.6
1959-1963		
.10 - 1.14	14	68.7
1.26 - 2.12	19	68.6
2.48 - 4.19	17	70.2
4.34 - 5.49	10	59.2
6.73 - 22.96	17	59.2

Source: Derived from data in Appendix B and Appendix C.

In order to test the hypothesis that the means of the populations from which the different risk classes were drawn are not all the same, the one-way analysis of variance is performed. This will indicate whether the differences in equity ratios identified by risk class in Tables 23 and 24 are significant or can be attributed to chance.

Empirical Findings

The Analysis of Variance of Equity Ratios

It was initially hypothesized that classifying the sample of firms according to a measure of earnings variability used as the surrogate for basic business risk, as opposed to an industry classification as the surrogate for business risk, would provide evidence that financial structures are influenced more by earnings variability than by industry groups. It was also thought that the evidence would point to an inverse relation between the use of fixed-charge financing and earnings variability. This would be the same as a direct relation between variability and equity ratios. The evidence in Tables 23 and 24 casts doubt on the direct relation between variability and equity financing. The relation indicated, however, could be attributed to chance and not to a systematic effort on the part of financial decision-makers to use less equity in response to greater variability.

This is precisely what the analysis of variance summarized in Tables 25-30 indicates. Six tests are performed, based on the classifications identified in Tables 23 and 24. Tables 25, 27, and 29 are based on variability in EBIT. Tables 26, 28, and 30 are based on variability in OIBD. This approach provides an objective measure of whether the equity ratios within a risk class differ in a significant manner from the mean equity ratios between the risk classes constructed. In Tables 25, 26, 29, and 30 the F-ratios needed for significance at the 1 and 5 percent levels are 3.60 and 2.50 respectively. In Tables 27 and 28 the F-ratios have to be larger for significance to be achieved, due to four risk classes constructed as opposed to five in the other four tests. In Tables 27 and 28 the critical F-ratios are 4.08 and 2.74 for the 1 percent and 5 percent levels respectively.

Tables 25 and 26 indicate that neither of the tests based on the variability measures derived from the 1959-1968 earnings streams is significant at either the 1 or 5 percent level. As is seen by the calculated mean square for each test, the variability within risk classes is slightly greater than the variability between risk classes. The differences in mean equity ratios can then be attributed to chance, and no inference can be made about the size of the

TABLE 25

Variability Classification
Based on EBIT--1959-1968
Common Equity Ratios--1968
Summary of the Analysis of Variance

Source of Variation	SS	df	MS	F
between groups	548	4	137.0	.97*
within groups	10144	72	140.9	
Total	10692	76		

*Accept null hypothesis at both 5 percent and 1 percent levels of significance.

Source: Computed from data in Appendix B and Appendix C.

TABLE 26

Variability Classification
Based on OIBD--1959-1968
Common Equity Ratios--1968
Summary of the Analysis of Variance

Source of Variation	SS	df	MS	F
between groups	477	4	119.3	.84*
within groups	10215	72	141.9	
Total	10692	76		

*Accept null hypothesis at both 5 percent and 1 percent levels of significance.

Source: Computed from data in Appendix B and Appendix C.

TABLE 27

Variability Classification
Based on EBIT--1964-1968
Common Equity Ratios--1968
Summary of the Analysis of Variance

Source of Variation	SS	df	MS	F
between groups	318	3	106.0	.75*
within groups	10374	73	142.1	
Total	10692	76		

*Accept null hypothesis at both 5 percent and 1 percent levels of significance.

Source: Computed from data in Appendix B and Appendix C.

TABLE 28

Variability Classification
Based on OIBD--1964-1968
Common Equity Ratios--1968
Summary of the Analysis of Variance

Source of Variation	SS	df	MS	F
between groups	339	3	113.0	.80*
within groups	10353	73	141.8	
Total	10692	76		

*Accept null hypothesis at both 5 percent and 1 percent levels of significance.

Source: Computed from data in Appendix B and Appendix C.

TABLE 29

Variability Classification
Based on EBIT--1959-1963
Common Equity Ratios--1963
Summary of the Analysis of Variance

Source of Variation	SS	df	MS	F
between groups	1245	4	311.3	1.74*
within groups	12903	72	179.2	
Total	14148	76		

*Accept null hypothesis at both 5 percent and 1 percent levels of significance. Reject null hypothesis at 25 percent level of significance.

Source: Computed from data in Appendix B and Appendix C.

TABLE 30

Variability Classification
Based on OIBD--1959-1963
Common Equity Ratios--1963
Summary of the Analysis of Variance

Source of Variation	SS	df	MS	F
between groups	1762	4	440.5	2.56*
within groups	12386	72	172.0	
Total	14148	76		

*Accept null hypothesis at 1 percent level of significance. Reject null hypothesis at 5 percent level of significance.

Source: Computed from data in Appendix B and Appendix C.

mean equity ratios being determined by greater or lesser risk, as measured by variability of earnings.

The same general relationship is also seen in Tables 27 and 28. In this case the variability measure used to classify firms is derived from a shorter time period, 1964-1968, and because of the shorter period the resulting standard errors are larger. Still, the variability measure does not provide an adequate explanation of the financing patterns of the 77 firms. The null hypothesis is again accepted at the 1 and 5 percent levels of significance. It is also noticed that the F-ratios derived over the 1964-1968 period are quite close to those derived over the longer 1959-1968 era.

In only two of the six tests is any significance observed. This is shown in Tables 29 and 30. Classifying firms by variability in EBIT over the period 1959-1963 does result in rejection of the null hypothesis at the 25 percent level. Classification based on variability in OTBD over the period 1959-1963 results in rejection of the null hypothesis at the 5 percent level. The F-ratio needed for significance at the 25 percent level is 1.38, and the F-ratio of 1.74 derived from EBIT variability exceeds this value. The F-ratio of 1.74, however, is not enough to reject the null hypothesis at the 5 percent level, where an F-ratio greater than

2.50 is needed. Construction of risk classes based on earnings variability over the 1959-1963 period does provide slight evidence of financial patterns being influenced by variability. There are, however, two problems with this result. First, the variance analysis based on the 1959-1968 period was not significant. This is seen in Tables 25 and 26. Had the analysis of variance based on the longer period risk classifications been significant, then the shorter period significance could be viewed as something other than an oddity. In statistical terms, this may very well be a case where the power of the test is not enough to prevent rejection of the null hypothesis when it is, in fact, true. The second reason that the results of the tests based on the 1959-1963 variability cannot be thought of as being too meaningful is because of the inverse relationship between risk and equity financing that was mentioned earlier. This observed relation, which is quite strong in the 1959-1963 risk classes, is probably due more to chance than to conscious financial policy. The discussion in Chapter II indicated that most financial theorists would reject such a relation as being an objective of rational financial management.

In other studies of large, non-financial firms, an inverse relation between risk and equity financing has occa-

sionally been reported. Petersen's (41) study is a case in point. Petersen found a direct relationship between three measures of leverage and an index of business risk, though the association was not statistically significant. While such a relationship may be at odds with traditional financial theory, there may be a rationale for such a condition. Should a firm find that non-equity sources of funds are the only sources of capital available, even in the face of widely varying earnings, little choice exists for the firm as to the form in which additional capital is raised. For purposes of expediency, the enterprise may be forced to issue a fixed-charge type of financing instrument to secure funds (23, p. 98). If the firm operates under conditions of excessive business risk, the suppliers of capital could demand that the firm offer its best security in order to raise funds.[1]

Based on this study, it is concluded that earnings variability by itself is not an effective substitute for an industry classification in attempting to explain differences in financial structures among large numbers of firms. Where financial structures appear to vary significantly by industry groupings, for the most part, significant differences have not been found when firms were grouped on the basis of an earnings variability classification.[2]

The Analysis of Variance of Earnings Variability

Reference to Table 31 provides further insight into this lack of significance that was obtained from the earnings variability analysis. Table 31 indicates the number of firms from each industry in the sample that fall into a specific risk class, based on EBIT variability over the period 1959-1968. It is noticed that the low variability risk class (.35-1.02) is dominated by 3 industries. These are drugs, paper, and retailing, which account for 75 percent of the 12 observations in this class. The mean equity ratio for the drug industry for 1968 was 67.7 percent; however, for the retail industry it was much lower at 56.5 percent. This general situation prevails throughout all risk classes. In other words, where risk classes are dominated by a few industries, these industries in many cases do not use financial leverage in a similar fashion. This makes for a wide variability of equity ratios within a given risk class and accounts for the lack of statistical significance in the mean equity ratios between risk classes. In the medium variability risk class (1.82-2.79) this is especially vivid. Firms in the auto parts, mining, and steel industries account for 10 of the 21 observations in this class. In 1968 the mining industry sample had a mean equity ratio of 78.8 percent, while that of the auto parts industry

TABLE 31

Number of Firms by Industry in a Particular Risk Class Based on 1959-1968 EBIT Variability

Class. / Ind.	.35-1.02	1.08-1.69	1.82-2.79	2.91-3.81	5.19-11.76	
	Number of Firms					Total
Air.			2	2	1	5
Alum.		1	2	1		4
Auto.		1	3	3	1	8
Chem.	1	4	2	1		8
Const.		2		1	3	6
Drugs	3	5				8
Glass		3	1			4
Mach.	2	2	2		1	7
Mining		1	4	1	1	7
Paper	3	2	1	1		7
Retail	3	2	1	1	1	8
Steel		1	3	1		5
Total	12	24	21	12	8	77

Source: Derived from data in Appendix C.

was only 48.5 percent. Again, the within-group variability is too high for this method of classifying firms to account for significant differences in financial structures.

The data in Table 31 give rise to another major point. More than half of the firms in all industries, except heavy construction, fall into adjacent risk classes. It is possible, therefore, that earnings variability differs significantly between industries, as the variability within industries seems to be rather small. Perhaps both equity ratios and earnings variability are a function of the industry in which the firm competes. If variability could be shown to vary significantly between industries, then additional substance would be added to the industrial classification method of approximating the equivalent risk class.[3] The null hypothesis to be tested is that the mean variability between industry groups is not significantly greater than the variability within industry groups, where the financial statistic under consideration is earnings variability. As six measures of variability have been calculated, three for each of the income streams investigated, six one-way analyses of variance can be performed. The results of the analysis of variance on earnings variability by industry are summarized in standard form in Tables 32-37.

In Tables 32 and 33 the analysis of variance is per-

TABLE 32

1959-1968 EBIT Variability
by Industry
Summary of the Analysis of Variance

Source of Variation	SS	df	MS	F
between groups	70	11	6.36	1.77*
within groups	234	65	3.60	
Total	304	76		

*Reject null hypothesis at 10 percent level of significance.

Source: Computed from data in Appendix C.

TABLE 33

1959-1968 OIBD Variability
by Industry
Summary of the Analysis of Variance

Source of Variation	SS	df	MS	F
between groups	53	11	4.82	2.47*
within groups	127	65	1.95	
Total	180	76		

*Reject null hypothesis at 5 percent level of significance.

Source: Computed from data in Appendix C.

TABLE 34

1964-1968 EBIT Variability
by Industry
Summary of the Analysis of Variance

Source of Variation	SS	df	MS	F
between groups	628	11	57.09	1.52*
within groups	2443	65	37.58	
Total	3071	76		

*Reject null hypothesis at 25 percent level of significance.

Source: Computed from data in Appendix C.

TABLE 35

1964-1968 OIBD Variability
by Industry
Summary of the Analysis of Variance

Source of Variation	SS	df	MS	F
between groups	447	11	40.64	2.00*
within groups	1321	65	20.32	
Total	1768	76		

*Reject null hypothesis at 5 percent level of significance.

Source: Computed from data in Appendix C.

TABLE 36

1959-1963 EBIT Variability
by Industry
Summary of the Analysis of Variance

Source of Variation	SS	df	MS	F
between groups	885	11	80.45	1.81*
within groups	2893	65	44.51	
Total	3778	76		

*Reject null hypothesis at 10 percent level of significance.

Source: Computed from data in Appendix C.

TABLE 37

1959-1963 OIBD Variability
by Industry
Summary of the Analysis of Variance

Source of Variation	SS	df	MS	F
between groups	440	11	40.00	2.00*
within groups	1299	65	19.98	
Total	1739	76		

*Reject null hypothesis at 5 percent level of significance.

Source: Computed from data in Appendix C.

formed on the antilog of the standard error of the regression coefficient for the two earnings streams over the period 1959-1968. An F-ratio of 1.77 is derived for EBIT variability, which exceeds the F-ratio of 1.68 needed for significance at the 10 percent level. This indicates that an F-ratio of 1.77 would be obtained less than 10 percent of the time, if the null hypothesis of no significance were true. Therefore, the null hypothesis is rejected at the 10 percent level of significance for the 9-year EBIT variability by industry test. The level of significance achieved when the variance analysis is performed on OIBD variability over the same period is even better than that achieved with EBIT variability. The resulting F-ratio of 2.47 exceeds by a wide margin the F-ratio of 1.94 needed for significance at the 5 percent level, and is very close to the F-ratio of 2.54 needed for significance at the 1 percent level. As was expected, the variance tests on both earnings streams provide strong evidence in favor of the hypothesis that earnings variability is directly affected by the industry in which the firm does business and that the mean variability between industries is significantly different.

It is also interesting to note that rather clear evidence is obtained when the variance analysis is performed over the shorter time periods under consideration. The

results of the tests over the 1964-1968 period are summarized in Tables 34 and 35. Keeping in mind that EBIT variability was not as distinct between industries as was OIBD variability over the 1959-1968 period, it is not surprising that the same relation is present over the shorter period analysis. In Table 34 it is seen that EBIT variability by industry yields an F-ratio of 1.52. This F-ratio of 1.52 is significant at the 25 percent level, where a ratio of 1.29 is needed for significance. In Table 35, where OIBD variability is tested by industry, an F-ratio of 2.00 results; this is significant at the 5 percent level. Over the shorter periods, where extreme variability measures are occasionally produced, it is to be expected that the F-ratios would be lower. Reference to Appendix C shows that for EBIT, over the period 1964-1968, 3 firms have a variability measure of over 30 percent. In contrast to this for the same income stream and over the 1959-1968 period, the highest variability measure is 11.76 percent. Even though extreme variations reduce the size of the F-ratios, the main point being made of significant differences in variability between industries appears to hold up well. The F-ratio of OIBD variability by industry is reduced in comparison to the longer period, but the level of significance of 5 percent is not even affected.

In Tables 36 and 37 the results of the analysis of variance test on variability by industry are presented for the period 1959-1963. The results are generally the same as those of the previous four tables. The F-ratio of 1.81 for EBIT variability is significant at the 10 percent level, and the F-ratio of 2.00 for OIBD variability is significant at the 5 percent level.

In considering all six tests, the stability in the F-ratios should be noted, which adds additional support to the rejection of the null hypothesis of no significant differences in mean variability between industries. It can be concluded that even over short periods the general economic forces that affect an industry affect the firms in that industry much to the same degree. Such results indicate that selection of an industry for studying financial structure patterns and the effect of financing decisions on the firm's cost of capital is a valid approach.

The Pariwise Test

In Chapter IV, where it was shown that inter-industry financial structures are significantly different, a follow-up test was performed to give some indication as to the pervasiveness of the differences in mean equity ratios. This same procedure can be followed in a further examination of earnings variability between industries. A pariwise test

(64, pp. 690-694) is performed on the mean variability between each of the industries being studied, but only for the period 1959-1968, for both variability measures. It is not necessary to test the shorter periods, because the relative variability in these shorter periods so closely follows the longer periods. This multiple comparison test will indicate which industries have mean variability measures that differ significantly from each other. The analysis of variance test does not indicate which particular industries have earnings variability measures that differ significantly from each other.

The results of the pariwise test on mean EBIT variability by industry are contained in Table 38. The test is performed at both the 10 percent level and the 25 percent level. Since the results of the EBIT variability analysis of variance test reported in Table 32 indicate that the F-ratio obtained is significant at the 10 percent level, the pariwise test cannot be performed at a more stringent level than 10 percent (64, p. 694). At the 10 percent level of significance it is seen that 14 of the 66 comparisons are significant. This indicates, for instance, that the difference between mean EBIT variability of 2.47 percent over the 1959-1968 period for the paper industry sample and the aircraft manufacturing industry sample would occur by chance less

TABLE 38

EBIT Variability by Industry Analysis
Test of Differences in Sample Means
(Percent)

Indust.	Air. x_j-x_1	Alum. x_j-x_2	Auto. x_j-x_3	Chem. x_j-x_4	Const. x_j-x_5	Drugs x_j-x_6	Glass x_j-x_7	Mach. x_j-x_8	Mining x_j-x_9	Paper x_j-x_{10}	Retail x_j-x_{11}
x_j											
x_{12}	-1.60*	.01	-1.32*	.63	-1.72*	1.32*	.67	.06	-.50	.87	-.22
x_{11}	-1.38*	.23	-1.10*	.85	-1.50*	1.54*	.89	.28	-.28	1.09	---
x_{10}	-2.47**	-.86	-2.19**	-.24	-2.59**	.45	-.20	-.81	-1.37*	---	
x_9	-1.10	.51	-.82	1.13	-1.22*	1.82**	1.17	.56	---		
x_8	-1.66*	-.05	-1.38*	.57	-1.78**	1.26*	.61	---			
x_7	-2.27**	-.66	-1.99**	-.04	-2.39**	.65	---				
x_6	-2.92**	-1.31	-2.64**	-.69	-3.04**	---					
x_5	.12	1.73*	.40	2.35**	---						
x_4	-2.23**	-.62	-1.95**	---							
x_3	-.28	1.33	---								
x_2	-1.61*	---									

Source: Computed from data in Appendix C.
**Significant at 10 percent level: 14 of 66 comparisons.
*Significant at 25 percent level only: 15 of remaining 52 comparisons.

TABLE 39

OIBD Variability by Industry Analysis
Test of Differences in Sample Means
(Percent)

Indust.	Air. x_j-x_1	Alum. x_j-x_2	Auto. x_j-x_3	Chem. x_j-x_4	Const. x_j-x_5	Drugs x_j-x_6	Glass x_j-x_7	Mach. x_j-x_8	Mining x_j-x_9	Paper x_j-x_{10}	Retail x_j-x_{11}
x_j											
x_{12}	-1.69**	.04	-1.14	.28	-1.72**	.72	.13	-.64	-1.43**	.49	-.42
x_{11}	-1.27*	.46	-.72	.70	-1.30**	1.14*	.55	-.22	-.01*	.91*	---
x_{10}	-2.18**	-.45	-1.63**	-.21	-2.21**	.23	-.36	-1.13*	-1.92**	---	
x_9	-.26	1.47**	.29	1.71**	-.29	2.15**	1.56**	.79	---		
x_8	-1.05*	.68	-.50	.92*	-1.08*	1.36**	.77	---			
x_7	-1.82**	-.09	-1.27*	.15	-1.85**	.59	---				
x_6	-2.41**	-.68	-1.86**	-.44	-2.44**	---					
x_5	.03	1.76**	.58	2.00**	---						
x_4	-1.97**	-.24	-1.42**	---							
x_3	-.55	1.18*	---								
x_2	-1.73**	---									

Source: Computed from data in Appendix C.
**Significant at 10 percent level: 23 of 66 comparisons.
*Significant at 25 percent level only: 11 of remaining 43 comparisons.

than 10 percent of the time. At the 25 percent level of significance 15 of the remaining 52 comparisons are significant; therefore, 29 of the 66 possible comparisons are significant at the 25 percent level. Four industries are involved in all of the significant comparisons at the 10 percent level. These 4 industries are aircraft manufacturing, automotive parts and accessories, heavy construction, and drugs. It must also be noticed that 3 industries are indistinguishable from any of the other industries at the 10 percent level of significance. These are aluminum, retail stores, and steel and iron. At the 25 percent significance level, however, all industries are involved in the significant comparisons.

In Table 39 the pariwise test on mean OIBD variability by industry is summarized. More significant comparisons should result with the 10 percent level test than resulted with the pariwise test summarized in Table 38, because the analysis of variance on OIBD variability was significant at the 5 percent level. This expectation is upheld, as 23 of the 66 possible comparisons are significant at the 10 percent level. At the 25 percent level an additional 11 comparisons are significant, so 34 of the 66 differences are significant at the 25 percent level. It is also noticed that all industries are involved in the significant comparisons at the 10 percent level.

The results of the pariwise tests indicate that the rejection of the null hypothesis of no significant differences in mean earnings variability between industries was due to rather pervasive differences in variability between all industries involved in the study. In general, it has been shown that an industry classification is a reasonable approximation of a homogeneous risk class.

In comparing the results of the pariwise tests performed in Chapter IV on mean equity ratios between industries and the tests performed in this chapter on mean variability by industry, it is clear that more pervasive results were obtained in the equity ratio analysis. This is not surprising. The individuals who are responsible for making the decision as to how the next increment of capital funds will be raised have a large measure of control over the selection of the financial instrument that will be issued to raise the funds. Their decision obviously will be subject to certain constraints imposed on the firm by the industry in which the firm does business and by the particular preferences of the firm's management and owners. If the firm's degree of leverage should appear to be out of line with industry norms or institutionally imposed norms, it only takes the proper decision on the financing of future investments to bring the degree of leverage into a more ac-

ceptable range. Earnings variability is another matter. The firm can alter the degree to which earnings before financing charges vary in response to a change in sales by altering the firm's use of operating leverage.[4] Being able to affect changes in sales volume, however, is less a factor of management control than it is a factor of aggregate and industry demand. For these reasons it is to be expected that the industry influence upon financing decisions is more distinct than industry influence upon variability in earnings.

Conclusion

This chapter has involved the statistical testing of the influence of earnings variability upon the equity ratios of a sample of 77 firms covering 12 industries. A comparison of industry influence upon financing patterns as opposed to earnings variability influence upon financing patterns has also been accomplished. In addition, the industry effect upon earnings variability has been documented.

Based upon the hypothesis that firms adjust their financial structures to the degree of business risk to which they have been accustomed over a previous period of time, the 77 firms were grouped according to an earnings variability measure of business risk. In contrast to the method of Chapter IV, an earnings variability surrogate for business

risk was used instead of an industry surrogate for business risk. Six measures of variability for each firm were obtained by performing a log-trend regression on two income streams for three periods of time. The antilog of the standard error of the regression coefficient for each regression equation provided a percentage variation around the least-squares trend line, and was used as the variability measure. For each time period, arbitrary risk classes ranging from low variability to high variability were constructed, and an analysis of variance on mean equity ratios between these risk classes was performed. It was originally thought that the influence of earnings variability upon financing decisions was strong enough to permit significant differences to result from this analysis of variance test. As Tables 25-30 indicate, for the most part, significant results were not obtained. The conclusion is that earnings variability by itself is not an effective method of classifying firms in order to explain differences in financial structures among large numbers of firms.

While the influence of earnings variability upon financing patterns was shown to be weaker than the influence of industry classes, it was noted in Table 31 that the variability of earnings within industry classes appeared rather small. It was, therefore, decided to test the hypothesis

that earnings variability differs significantly between industry classes. Should the null hypothesis of no significant differences be rejected, then evidence would be provided lending support to the use of industry classes as approximations of homogeneous risk classes. This would be the case because both financial structure and earnings variability would be seen to depend upon the industry in which the firm competes. Tables 32-37 infer that earnings variability does differ significantly between industry groupings. As the conventional analysis of variance only says that all of the mean variability industry measures are not drawn from the same population, a pariwise test was performed over the longer time periods investigated; these tests are summarized in Tables 38 and 39. The results indicate that the analysis of variance significance was not due to one or two industries. Instead, at the 25 percent level of significance all industries were involved in the significant comparisons for both earnings streams studied. Based on this evidence it is concluded that earnings variability does differ significantly between industry classifications and that industry groupings are reasonable approximations of homogeneous risk classes.

A final comment must be made on the results of the earnings variability analysis. Traditional business finance

writers have emphasized that earnings variability is a prime determinant of financial structure. In Chapter II of this study the discussion of the work of Edward S. Mead (34) during the formative period of the traditional position indicated that the importance of earnings variability has been stressed for many years. A direct relation between earnings variability and equity ratios, or an indirect relation between earnings variability and debt ratios, is implied. Statements to this effect can be found in recent textbooks on financial management. Consider this comment by Prather:

> Debt financing or trading on equity magnifies gains and losses of a corporation; and the extent to which a corporation embarks on debt financing relative to equity depends on the stability of income. (42, p. 519)

Prather seems to indicate that variability in earnings is the most important factor affecting the extent to which a firm will lever itself. Guthmann and Dougall take a position similar to that of Prather. In the 1962 edition of Corporate Financial Policy they write:

> Probably the most important internal factor is stability, or certainty of expected earnings.
>
> Unstable earnings--whatever their cause--make the use of bonds dangerous and less attractive to bond buyers. Corporations subject to this risk should avoid bonds, keep preferred stocks at a minimum, and favor common stock and retained earnings as sources of funds. (22, p. 224)

The results of the analysis of variance of equity

ratios reported in this chapter do not reinforce this traditional view that financial structures vary with earnings instability. Such a finding deserves an explanation.

It appears that the financial structures of firms are affected by many factors. Variability in earnings is only one of these. Some other important determinants of the financial structures of individual firms are:[5]

1. The level of earnings
2. The rate of earnings growth
3. The liquidity of assets
4. Dividend payout policy
5. The nature of competition
6. The level and stability of investment opportunities

For a particular firm any of the above variables could be more significant than earnings variability in affecting that firm's financing mix. For instance, the firm expecting with certainty a high level of earnings, but facing a low level of investment opportunity, may use very little leverage. This type of profitable enterprise could finance a small investment program out of internally generated funds.

In contrast to the firm with a high level of regular earnings, consider the firm less profitable with a rather irregular earnings pattern. Such a firm, experiencing wide earnings variability but facing a high level of investment

opportunity, may have to lever itself to a greater degree than the former firm in order to take advantage of the promising projects. Internally generated funds may not be available in large enough amounts to finance the anticipated profitable investment program. Even the successful firm with a pattern of regular earnings will find that the volume of internal funds for expansion is small if a high dividend payout policy is followed.

The drug industry provides a lucid example of the influence of competition on financial structures. The severity of competition in this industry has been noted by Alderson (2, pp. 108-109). Of all industries examined in this study, the drug industry exhibited the least variability in earnings. The mean equity ratio of this industry in 1968, however, was exceeded only by that of the mining industry. The emphasis on product innovation and the uncertainty which surrounds this activity seem to make financial decision-makers in the drug industry reluctant to accept a high degree of financial risk. In addition, the high level of earnings achieved by firms in this industry has kept at a minimum the need to rely on external funds to finance investment.

In addition to the variables which have been identified, two other factors could be considered which have a

rather random effect on the financial structures of firms. These are the individual preferences of managements and owners towards leverage and the state of the financial markets at a given point in time (30, p. 335). Because of the interaction among several variables, a single factor such as earnings variability may well not account for differences in financial structures among firms.

The following statement by Lindsay and Sametz is in agreement with the major conclusions of this study:

> If we can determine the kind of capital structure that the nature of the industry seems to call for, then all firms within that industry are likely to reveal a rough similarity in capital structure. (30, p. 336)

The results of the industry analysis detailed in Chapter IV of this dissertation quantify the above assertation by Lindsay and Sametz. It has been shown that industry groupings can account for significant differences in financial structures among several firms. Earnings variability, then, is only one of several factors that influence financing decisions, but most of these factors are a function of the industry in which the firm does business.

NOTES

[1]With specific reference to the aircraft manufacturing industry, it should be noted that a high degree of leverage can be incurred because of the large amount of receivables that most firms in this industry carry and because of the prospective receipt of progress payments on long-term contracts. These expected receipts enable such firms to finance a large portion of their assets by means of notes and accounts payable, even in the face of widely varying earnings. Johnson (26, pp. 409-410) briefly discusses this point.

Such an unusual case raises the possibility that the empirical findings of this study might be influenced by unusual conditions in other industries. As no single industry in this study accounts for more than 8 of the 77 firms, or 10.4 percent, the probability of such a problem is not high. Further, to destroy the results, a systematic bias would have to be present in several of the 12 industries surveyed. No such bias seems to exist.

[2]Throughout this study consistent results were obtained with the use of either variability measure; that is, whether variability was based on EBIT or OIBD did not alter the conclusion drawn from the analysis.

[3]Wippern (61) tested a similar hypothesis and found variability to differ significantly by industry. His study, however, covered only 7 industries and 49 firms. In addition, of the 49 firms, 17 or 35 percent are electric utilities.

[4]Operating leverage is a measure of the extent to which the firm uses operating fixed costs as opposed to financial fixed costs. Exceptionally good discussions on this subject can be found in Grunewald and Nemmers (17, pp. 70-77) and Johnson (26, pp. 244-249).

[5]A discussion of all the variables listed below is not attempted here, as such elaboration can be found in many of the better financial management texts. Excellent presentations can be found in Lindsay and Sametz (30, pp. 319-337), Johnson (26, pp. 259-267), and Weston and Brigham (59, pp. 294-297).

CHAPTER VI

SUMMARY AND CONCLUSIONS

The main objective of this study has been to test for the existence of optimum financial structures. A secondary objective has been to determine whether an industry classification of firms or an earnings variability classification provides a better method of grouping firms for purposes of studying and explaining financial structure patterns.

The importance of financial structure decisions was minimized in a provocative article published by Professors Franco Modigliani and Merton H. Miller (36) in 1958. In its extreme and simple form the independence hypothesis formulated by these theorists asserts that the market value of the firm is unaffected by its financial structure; this implies that the cost of capital funds to the enterprise is independent of the degree to which the firm is levered. In a later article Modigliani and Miller (37) acknowledge a greater tax advantage from the use of debt financing than they originally did, but still maintain that the tax advantage is the only advantage of debt financing. This view

is in conflict with the more traditional view that debt may be several times cheaper than equity in financing the firm's assets (36, p. 126).

In order to identify and clarify the relevant differences between the traditional view on financial structure and the view held by proponents of the independence hypothesis, the development and meaning of each theory was presented in detail. The traditional view was discussed in terms of a formative period, a transitional period, and a formalization period. It was found that the basic concepts of the traditional view were presented during the formative period of 1910-1930, but unified presentations of the traditional view were not observable until the rigorous challenge of the independence hypothesis was offered. Whether their position is right or wrong, the proponents of the independence hypothesis forced traditional theorists to formalize their point of view and to conduct empirical tests of that view. This may be the lasting benefit provided to financial theory by the controversy surrounding the independence hypothesis.

The review of several studies employing either multiple or simple regression analysis as the major statistical tool in testing for the effect of leverage on the cost of capital and earnings yields showed inconclusive or ambiguous results. It was decided to use another method of empirical

testing in this study. An investigation of the effect of varying degrees of leverage on the cost of capital of firms was not attempted. So this study is not a direct test of Modigliani and Miller's Propositions I and II. A surrogate or substitute approach is taken in testing for the existence of optimum financial structures. The idea for such an approach has been expressed by several theorists in the literature of finance. In Chapter III of this paper expressions by Guthmann and Dougall (22, p. 235) and Solomon (47, pp. 97-98) were identified which suggested a surrogate method of empirical testing. Weston has likewise recognized the efficacy of such an approach. In discussing the original empirical tests that Modigliani and Miller offered in support of their Propositions I and II, Weston remarked:

> If the cost of capital were the same for a risk class, regardless of the degree of financial leverage employed, how can one explain the concentration of leverage ratios in the 45-65 percent range for the electrical utility companies? If it were truly a matter of indifference, one should expect to find a relatively uniform scatter for both the diagrams rather than a concentration at high leverage for the electric utilities and a tendency toward the low leverage end for the oil companies. (54, p. 158)

Several implications are present in the above statement by Weston. He has asserted: (1) that the cost of capital is not independent of the degree of financial leverage used by firms in a particular risk class, (2) that firms have

searched for and found optimum ranges of financial leverage for a risk class, and (3) the industry classification is an appropriate means of approximating the equivalent risk class. The major thought in the above statement by Weston is that financial structures vary in a significant manner between industry risk classes. This study quantifies such an assertation and upholds it.

Guthmann and Dougall, Solomon, and Weston have all hinted that if significant differences could be shown to exist between the financial structures of a sample of firms, classified by industry groups, such evidence would support the existence of optimum financial structures. Therefore, such an approach is a substitute for the often ambiguous method of testing for the effect of leverage on the cost of capital.

In their 1967 article Schwartz and Aronson (45) used the surrogate approach suggested by Guthmann and Dougall, Solomon, and Weston. Using the one-way analysis of variance statistical technique, Schwartz and Aronson found that significant differences exist between the mean equity ratios of a sample of firms covering 4 industries. The study herein adopted the technique used by Schwartz and Aronson but attempted to improve upon their results in four ways: (1) more industries were examined, 12 instead of only 4; (2)

utilities and railroads were omitted in this study to minimize the effect of regulatory bodies on financing decisions; (3) 10 consecutive years, 1959-1968, were tested in this study whereas Schwartz and Aronson tested only 1961 and 1928; and (4) a pariwise test was performed for each year covered in the study to give some indication as to the pervasiveness of the significant differences in mean equity ratios between industries.

The results of the industry classification of firms and the analysis of variance procedure on equity ratios were highly significant in each of the 10 years studied. The F-ratios calculated ranged from 5.39 in 1960 to 15.69 in 1968, thus exceeding by a comfortable margin the F-ratio of 2.54 needed for this sample size to be significant at the 1 percent level. The results of the pariwise test were also impressively in favor of the traditional view on financial structure. Of the 66 mean equity ratio comparisons to be tested between industries, the lowest number turning out to be significant at the 1 percent level in any year was 24 in 1959, while the greatest was 36 in 1968. As any one industry could account for at most 11 significant differences, the rejection of the null hypothesis tested by the analysis of variance was due to rather pervasive financial structure differences between the 12 industries examined. Based upon

the analysis of variance performed on the equity ratios of firms classified by industry, it is concluded that optimum financial structures exist. Therefore, when the industry is used as a surrogate for business risk, significantly different financial structure patterns are observable between industries. The evidence indicates that firms in an industry cluster in an optimum equity range, or, conversely, leverage range, and that this range is significantly different between the groups studied.

This study took a second approach in seeking to identify significant financial structure patterns among firms. The same sample of 77 firms was used, but the industry approach to approximating business risk was dropped and replaced by an earnings variability approach. The variability measure used was the antilog of the standard error of the regression coefficient of a log-trend regression. This provides a percentage variation around a least-squares growth rate for the particular income stream used in the calculation. Two income streams before financing charges were used. These were earnings before interest and taxes per share (EBIT) and operating income before depreciation per share (OIBD). The latter measure, OIBD, removes the effect of different depreciation policies used by firms. As it turns out, the major conclusions of the study are not affected by the use

of one income stream or the other. By taking each of these income streams on a per share basis for three periods of time, six measures of variability were derived for each firm. Variability risk classes were then arbitrarily constructed and the 77 firms were grouped into either four or five classes ranging from low variability to high variability. The analysis of variance procedure was then used to test for significant differences in financial structures between these variability risk classes. The hypothesis that an earnings variability surrogate for business risk is more appropriate than an industry surrogate in explaining financial structure differences was not upheld. In only two of the six cases tested were significant results obtained, and in one of these, the null hypothesis of no significant differences was rejected at the 25 percent level. The conclusion from this evidence is that an industry grouping of firms is more appropriate than an earnings variability classification in explaining differences in the financial structures of firms. Stability in earnings does not appear to be as important a determinant of financial structure as many traditional writers have hypothesized. It seems that earnings variability is one of several attributes of business risk which influence the firm's financing decisions. Most of these attributes are accounted for by industry groupings.

In order to test further the logic behind using an industry classification of firms as an approximation of the equivalent risk class, the analysis of variance was performed on earnings variability by industry for each of the six measures of variability derived in the study. If within industries the variability of earnings of the respective firms is relatively small as opposed to the variability of earnings between industries, then within a particular industry the financial decision-makers probably view the inherent business risks of that industry in a similar manner. This would tend to reinforce the findings of the industry analysis where intra-industry financial structure differences were found to be statistically insignificant in relation to inter-industry differences. The null hypothesis of no significant differences was rejected in all six tests at different levels of significance, ranging from the 5 percent level to the 25 percent level. The pariwise test was performed on the mean variability measures between industries for each income stream studied over the 1959-1968 time period. The results of the pariwise tests indicated that rejection of the null hypothesis in the analysis of variance was due to rather widespread differences in variability between industries. This evidence permits the conclusion to be drawn that earnings variability differs significantly between industry classes.

The major conclusions of the study are: (1) optimum financial structures (are perceived to) exist, and are statistically observable as represented by significantly different equity ratios between industries; (2) the industry classification of firms is superior to an earnings variability classification for purposes of studying financial structure patterns; and (3) earnings variability differs significantly between industry classes, adding weight to the use of industry groupings for approximating equivalent risk classes.

APPENDIX A

LIST OF SAMPLE FIRMS

LIST OF SAMPLE FIRMS

Aircraft Manufacturing

1. Boeing Company
2. Lockheed Aircraft Corporation
3. McDonnell Douglas Corporation
4. North American Rockwell Corporation
5. United Aircraft Corporation

Aluminum

1. Alcan Aluminum Limited
2. Aluminum Company of America
3. Kaiser Aluminum and Chemical Corporation
4. Reynolds Metals Company

Automotive Parts and Accessories

1. Bendix Corporation
2. Budd Company
3. Clark Equipment Company
4. Eaton Yale and Towne, Incorporated
5. Fruehauf Corporation
6. Houdaille Industries, Incorporated
7. Libbey-Owens-Ford Company
8. Scovill Manufacturing Company

Chemicals

1. Allied Chemical Corporation
2. Atlas Chemical Industries, Incorporated
3. Chemetron Corporation
4. Hercules, Incorporated
5. Monsanto Company
6. Olin Mathieson Chemical Corporation
7. Stauffer Chemical Company
8. Union Carbide Corporation

Heavy Construction and Supplies

1. Allis-Chalmers Manufacturing Company
2. Bucyrus-Erie Company
3. Caterpillar Tractor Company
4. Flintkote Company
5. Ingersoll-Rand Company
6. Pullman, Incorporated

Drugs and Medicines

1. Abbott Laboratories
2. American Cyanamid Company
3. Kendall Company
4. Merck and Company, Incorporated
5. Schering Corporation
6. Smith, Kline and French Laboratories
7. Sterling Drug, Incorporated
8. Warner-Lambert Pharmaceutical Company

Glass, Glassware, and Containers

1. Anchor Hocking Corporation
2. Corning Glass Works
3. Owens-Illinois, Incorporated
4. PPG Industries, Incorporated

Machinery

1. Babcock and Wilcox Company
2. Cincinnati Milling Machine Company
3. Crown Cork and Seal Company, Incorporated
4. Ex-Cell-O Corporation
5. Joy Manufacturing Company
6. Pitney-Bowes, Incorporated
7. Rex Chainbelt Company

Mining

1. American Smelting and Refining Company
2. Anaconda Company
3. Freeport Sulphur Company
4. International Nickel Company of Canada, Limited
5. Kennecott Copper Corporation
6. Phelps Dodge Corporation
7. St. Joseph Lead Company

Paper, Lumber and Wood Products

1. Crown Zellerbach Corporation
2. International Paper Company

Paper, Lumber and Wood Products (continued)

3. Kimberly-Clark Corporation
4. Scott Paper Company
5. St. Regis Paper Company
6. Union Camp Corporation
7. Weyerhaeuser Company

Department and Variety Retail Stores

1. Federated Department Stores, Incorporated
2. W. T. Grant Company
3. S. S. Kresge Company
4. R. H. Macy and Company, Incorporated
5. Marshall Field and Company
6. J. J. Newberry Company
7. J. C. Penney Company
8. F. W. Woolworth Company

Steel and Iron

1. Armco Steel Corporation
2. Bethlehem Steel Corporation
3. National Steel Corporation
4. Republic Steel Corporation
5. Youngstown Sheet and Tube Company

APPENDIX B

INDUSTRY ANALYSIS SAMPLE DATA

TABLE 40

Industry Analysis
Common Equity Ratios: 1968
(Percent)

Ind. / Firm*	Air.	Alum.	Auto.	Chem.	Const.	Drugs	Glass	Mach.	Mining	Paper	Retail	Steel
1	42.0	44.6	41.1	57.9	45.5	64.7	67.6	51.7	80.0	61.9	67.5	61.1
2	38.6	54.7	44.4	56.3	77.0	71.8	69.8	60.1	71.7	64.6	55.1	64.1
3	31.9	38.5	54.2	64.3	53.4	61.0	47.5	52.2	86.1	63.3	51.1	65.6
4	39.3	39.6	51.9	54.2	56.7	75.9	62.9	63.5	77.8	69.0	40.8	64.4
5	37.6		47.2	61.2	53.0	66.8		59.3	69.8	56.9	68.2	68.6
6			55.2	66.3	55.1	74.1		48.2	84.7	57.5	50.8	
7			47.3	56.5		62.8		52.8	81.2	66.9	50.5	
8			46.9	53.1		64.6					67.8	
Mean	37.9	44.4	48.5	58.7	56.8	67.7	62.0	55.4	78.8	62.9	56.5	64.8
Industry Code	x_1	x_2	x_3	x_4	x_5	x_6	x_7	x_8	x_9	x_{10}	x_{11}	x_{12}

Source: Computed from Dominick and Dominick (9).
*Represents corresponding firm identified in Appendix A by industry.

TABLE 41

Industry Analysis
Common Equity Ratios: 1967
(Percent)

Ind. / Firm*	Air.	Alum.	Auto.	Chem.	Const.	Drugs	Glass	Mach.	Mining	Paper	Retail	Steel
1	41.3	43.9	41.6	56.3	55.7	70.3	66.7	60.1	80.0	59.7	67.0	63.0
2	40.3	55.1	50.5	59.0	78.1	73.7	70.5	60.4	79.4	72.7	50.9	67.4
3	19.0	39.7	56.3	66.4	57.5	63.1	47.3	47.4	85.7	66.6	55.6	69.2
4	47.6	42.6	57.9	57.5	56.8	73.4	64.0	61.5	90.2	69.0	40.9	65.4
5	37.6		50.2	60.1	63.4	72.5		59.7	91.3	57.7	68.4	67.6
6			45.6	66.7	54.7	75.9		61.2	86.4	68.1	50.3	
7			88.7	55.4		63.0		67.4	81.7	67.1	56.8	
8			45.6	53.8		56.3					71.5	
Mean	37.2	45.3	54.6	59.4	61.0	68.5	62.1	59.7	85.0	65.8	57.7	66.5
Industry Code	x_1	x_2	x_3	x_4	x_5	x_6	x_7	x_8	x_9	x_{10}	x_{11}	x_{12}

Source: Computed from Dominick and Dominick (9).
*Represents corresponding firm identified in Appendix A by industry.

TABLE 42

Industry Analysis
Common Equity Ratios: 1966
(Percent)

Ind. / Firm*	Air.	Alum.	Auto.	Chem.	Const.	Drugs	Glass	Mach.	Mining	Paper	Retail	Steel
1	42.1	44.0	55.6	57.6	51.2	74.6	64.3	63.7	76.4	60.8	65.6	69.7
2	43.5	54.1	57.5	63.2	76.4	71.3	65.9	56.9	84.2	79.3	48.7	73.6
3	22.1	36.5	49.2	57.3	65.5	63.2	52.0	43.9	85.7	70.4	61.2	68.3
4	59.2	43.0	59.2	63.3	54.3	71.3	65.9	63.9	90.1	72.9	40.2	67.9
5	40.3		51.5	57.1	59.0	71.9		61.2	89.6	63.9	67.4	67.8
6			36.7	54.2	49.9	74.4		67.5	85.8	67.8	49.9	
7			87.2	61.0		59.1		74.2	78.4	66.3	58.5	
8			49.3	61.4		52.9					71.0	
Mean	41.4	44.4	55.8	59.4	59.4	67.3	62.0	61.6	84.3	68.8	57.8	69.5
Industry Code	x_1	x_2	x_3	x_4	x_5	x_6	x_7	x_8	x_9	x_{10}	x_{11}	x_{12}

Source: Computed from Dominick and Dominick (9).
*Represents corresponding firm identified in Appendix A by industry.

TABLE 43

Industry Analysis
Common Equity Ratios: 1965
(Percent)

Ind. / Firm*	Air.	Alum.	Auto.	Chem.	Const.	Drugs	Glass	Mach.	Mining	Paper	Retail	Steel
1	45.6	42.4	64.5	64.0	52.4	75.3	74.5	67.0	74.9	63.1	64.3	69.0
2	46.1	55.0	61.5	68.6	71.8	69.6	80.1	60.4	84.2	85.1	49.4	68.5
3	49.0	38.3	52.1	58.9	64.5	65.6	58.8	43.0	90.7	75.6	62.9	67.5
4	55.8	44.1	59.9	70.7	50.1	76.0	76.1	69.3	88.3	76.6	41.3	67.6
5	50.0		50.1	56.2	64.6	70.6		61.3	91.9	69.7	66.3	67.8
6			36.8	56.7	60.9	70.5		67.3	87.6	67.2	49.8	
7			84.6	64.3		66.8		74.5	75.9	77.9	61.6	
8			55.9	59.6		55.8					70.4	
Mean	49.3	45.0	58.2	62.4	60.7	68.8	72.4	63.3	84.8	73.6	58.3	68.1
Industry Code	x_1	x_2	x_3	x_4	x_5	x_6	x_7	x_8	x_9	x_{10}	x_{11}	x_{12}

Source: Computed from Dominick and Dominick (9).
*Represents corresponding firm identified in Appendix A by industry.

TABLE 44

Industry Analysis
Common Equity Ratios: 1964
(Percent)

Ind. / Firm*	Air.	Alum.	Auto.	Chem.	Const.	Drugs	Glass	Mach.	Mining	Paper	Retail	Steel
1	45.1	43.1	67.6	68.0	57.1	74.6	74.3	67.0	75.4	69.4	67.6	74.9
2	46.0	55.7	57.2	73.6	58.5	71.0	78.4	66.7	84.1	84.8	57.2	70.2
3	51.3	38.8	53.8	62.0	60.6	66.2	59.7	46.9	94.9	75.6	66.6	65.7
4	49.0	45.8	63.9	71.0	49.6	75.6	76.1	69.2	89.4	79.9	44.2	67.0
5	46.2		57.0	59.0	67.1	71.7		65.0	89.8	68.9	66.4	70.3
6			47.6	54.9	60.7	72.5		68.9	89.6	66.5	52.5	
7			85.6	65.8		67.5		72.8	69.9	82.8	68.1	
8			65.6	60.6		56.7					68.3	
Mean	47.5	45.9	62.3	64.4	58.9	69.5	72.1	65.2	84.7	75.4	61.4	69.6
Industry Code	x_1	x_2	x_3	x_4	x_5	x_6	x_7	x_8	x_9	x_{10}	x_{11}	x_{12}

Source: Computed from Dominick and Dominick (9).
*Represents corresponding firm identified in Appendix A by industry.

TABLE 45

Industry Analysis
Common Equity Ratios: 1963
(Percent)

Firm* \ Ind.	Air.	Alum.	Auto.	Chem.	Const.	Drugs	Glass	Mach.	Mining	Paper	Retail	Steel
1	39.7	41.9	64.3	67.9	59.5	70.7	77.6	67.4	76.3	69.8	74.2	75.2
2	39.5	58.6	66.3	67.5	63.1	70.6	76.3	69.7	82.8	85.0	56.6	71.8
3	44.8	39.2	52.8	60.7	58.3	64.4	54.9	46.8	94.1	73.8	70.8	65.6
4	38.8	43.8	63.0	81.7	46.3	78.5	74.1	69.4	91.4	76.6	39.9	69.8
5	46.1		52.6	57.6	75.1	68.2		68.0	93.0	68.1	66.1	69.3
6			45.0	54.0	73.9	70.8		66.1	90.2	77.4	45.5	
7			83.3	76.2		66.2		71.5	76.2	85.9	60.0	
8			71.7	61.7		58.2					66.9	
Mean	41.8	45.9	62.4	65.9	62.7	68.5	70.7	65.6	86.3	76.7	60.0	70.3
Industry Code	x_1	x_2	x_3	x_4	x_5	x_6	x_7	x_8	x_9	x_{10}	x_{11}	x_{12}

Source: Computed from Dominick and Dominick (9).
*Represents corresponding firm identified in Appendix A by industry.

TABLE 46

Industry Analysis
Common Equity Ratios: 1962
(Percent)

Firm* \ Ind.	Air.	Alum.	Auto.	Chem.	Const.	Drugs	Glass	Mach.	Mining	Paper	Retail	Steel
1	41.3	42.5	62.3	66.4	62.6	70.9	76.1	66.4	76.4	68.4	70.3	74.9
2	29.8	59.9	66.7	62.2	63.5	69.9	76.8	74.4	83.1	84.6	56.4	74.6
3	49.2	39.5	54.5	57.6	60.3	62.1	52.7	44.5	93.0	73.1	76.9	63.5
4	35.3	43.7	69.9	79.1	44.9	77.8	82.8	68.8	91.8	73.9	42.5	68.6
5	47.7		52.2	56.1	77.2	68.8		68.6	92.3	69.9	65.3	69.2
6			43.9	51.6	75.9	71.0		64.6	90.2	72.8	46.8	
7			84.5	75.4		63.7		71.3	73.5	85.6	68.3	
8			69.5	59.9		57.1					70.6	
Mean	40.7	46.4	62.9	63.5	64.1	67.7	72.1	65.5	85.8	75.5	62.1	70.2
Industry Code	x_1	x_2	x_3	x_4	x_5	x_6	x_7	x_8	x_9	x_{10}	x_{11}	x_{12}

Source: Computed from Dominick and Dominick (9).
*Represents corresponding firm identified in Appendix A by industry.

TABLE 47

Industry Analysis
Common Equity Ratios: 1961
(Percent)

Ind. / Firm*	Air.	Alum.	Auto.	Chem.	Const.	Drugs	Glass	Mach.	Mining	Paper	Retail	Steel
1	43.5	42.2	63.8	66.7	65.2	71.7	73.9	67.6	76.6	66.8	69.1	73.4
2	23.2	56.7	64.6	66.2	64.1	69.2	75.1	71.7	87.2	83.8	52.2	72.2
3	56.3	37.8	60.2	55.4	55.1	62.0	50.6	47.9	94.2	72.3	77.8	59.6
4	40.1	42.7	83.1	77.7	42.7	77.9	82.7	74.4	87.8	71.0	38.5	66.4
5	49.4		53.3	59.2	79.6	69.5		66.6	92.5	71.1	62.3	67.4
6			42.7	50.7	78.2	71.1		64.7	90.2	70.1	48.9	
7			83.2	74.3		59.7		77.1	70.8	87.0	68.6	
8			69.6	58.1		68.8					70.1	
Mean	42.5	44.9	65.1	63.5	64.2	68.7	70.6	67.1	85.6	74.6	60.9	67.8
Industry Code	x_1	x_2	x_3	x_4	x_5	x_6	x_7	x_8	x_9	x_{10}	x_{11}	x_{12}

Source: Computed from Dominick and Dominick (9).
*Represents corresponding firm identified in Appendix A by industry.

TABLE 48

Industry Analysis
Common Equity Ratios: 1960
(Percent)

Ind. / Firm*	Air.	Alum.	Auto.	Chem.	Const.	Drugs	Glass	Mach.	Mining	Paper	Retail	Steel
1	43.6	43.0	60.6	66.2	63.9	67.8	75.2	66.2	74.7	65.8	70.0	72.4
2	17.3	56.2	63.9	75.6	55.6	69.7	74.6	69.9	86.1	84.4	67.0	72.4
3	59.0	37.1	52.8	53.8	53.7	65.8	50.4	56.2	93.5	76.3	78.8	63.2
4	53.8	42.7	81.4	76.2	44.0	79.3	79.8	79.3	88.9	56.4	36.9	66.5
5	49.0		53.7	57.7	80.9	71.0		65.8	92.4	71.1	61.6	66.3
6			40.3	49.2	77.5	72.3		72.8	90.5	70.7	56.3	
7			80.2	76.0		56.0		81.6	70.0	87.0	70.5	
8			72.2	56.7		69.3					70.4	
Mean	44.5	44.8	63.1	63.9	62.6	68.9	70.0	70.3	85.2	73.1	63.9	68.2
Industry Code	x_1	x_2	x_3	x_4	x_5	x_6	x_7	x_8	x_9	x_{10}	x_{11}	x_{12}

Source: Computed from Dominick and Dominick (9).
*Represents corresponding firm identified in Appendix A by industry.

TABLE 49

Industry Analysis
Common Equity Ratios: 1959
(Percent)

Ind. / Firm*	Air.	Alum.	Auto.	Chem.	Const.	Drugs	Glass	Mach.	Mining	Paper	Retail	Steel
1	34.5	42.0	60.6	64.7	61.1	67.9	72.8	65.1	73.2	63.9	69.7	68.4
2	22.2	55.3	59.0	75.6	63.3	68.7	72.4	77.3	84.7	83.6	66.6	72.0
3	45.0	36.7	48.2	52.6	57.2	63.9	47.7	46.9	92.1	73.5	77.5	60.7
4	52.6	40.4	76.6	78.4	59.9	77.5	76.5	81.0	87.5	54.2	36.3	72.5
5	48.3		47.8	61.7	79.6	69.0		66.6	94.5	66.5	60.1	67.8
6			40.0	47.1	79.4	70.8		73.1	91.3	69.0	53.2	
7			73.8	72.1		54.8		80.2	69.6	86.5	67.2	
8			69.4	56.3		65.3					63.9	
Mean	40.5	43.6	59.4	63.6	66.8	67.2	67.4	70.0	84.7	71.0	61.8	68.3
Industry Code	x_1	x_2	x_3	x_4	x_5	x_6	x_7	x_8	x_9	x_{10}	x_{11}	x_{12}

Source: Computed from Dominick and Dominick (9).
*Represents corresponding firm identified in Appendix A by industry.

APPENDIX C

EARNINGS VARIABILITY ANALYSIS SAMPLE DATA

TABLE 50

EBIT Variability Data

Industry and Firm	Percentage Variability		
	1959-1968	1964-1968	1959-1963
Aircraft			
Boeing	2.78	5.70	9.47
Lockheed	3.81	4.27	13.87
McDonnell	7.29	37.68	6.06
Rockwell	2.20	3.20	5.96
United Aircraft	3.56	3.13	14.08
Mean (x_1)	3.93	10.80	9.89
Aluminum			
Alcan	1.36	3.60	3.74
ALCOA	2.46	4.60	8.19
Kaiser	2.16	6.29	4.13
Reynolds	3.31	9.48	6.88
Mean (x_2)	2.32	5.99	5.74
Auto Parts			
Bendix	2.36	3.23	1.00
Budd	11.76	34.32	52.89
Clark	3.18	3.64	13.99
Eaton	3.09	6.15	11.72
Fruehauf	2.45	3.68	10.53
Houdaille	1.24	3.50	4.66
LOF	1.96	5.45	4.42
Scovill	3.19	7.78	8.63
Mean (x_3)	3.65	9.68	13.48

Source: Computed from Dominick and Dominick (9).

TABLE 50 (continued)

Industry and Firm	Percentage Variability		
	1959-1968	1964-1968	1959-1963
Chemicals			
Allied	2.06	6.40	3.76
Atlas	1.82	2.56	2.75
Chemetron	2.93	9.01	4.50
Hercules	.80	3.05	1.31
Monsanto	1.52	2.08	2.38
Olin Mathieson	1.66	6.87	1.53
Stauffer	1.42	2.36	2.81
Union Carbide	1.36	3.92	2.61
Mean (x_4)	1.70	4.53	2.71
Construction			
Allis-Chalmers	7.85	31.09	10.96
Bucyrus-Erie	5.57	6.54	17.60
Caterpillar	2.91	5.74	4.14
Flintkote	1.45	5.01	2.12
Ingersoll-Rand	1.30	2.87	.83
Pullman	5.19	10.15	10.39
Mean (x_5)	4.05	10.23	7.67
Drugs			
Abbott	1.08	1.42	4.52
American Cyanamid	1.45	4.70	3.07
Kendall	1.14	1.99	1.53
Merck	1.47	2.70	2.98
Schering	1.40	.89	2.94
SKF	.50	1.11	1.30
Sterling	.65	.88	.36
Warner-Lambert	.36	1.37	.95
Mean (x_6)	1.01	1.88	2.21

TABLE 50 (continued)

Industry and Firm	Percentage Variability		
	1959-1968	1964-1968	1959-1963
Glass			
Anchor Hocking	2.41	3.77	2.39
Corning Glass	1.27	5.41	2.64
Owens-Illinois	1.69	4.10	3.18
PPG Industries	1.26	2.70	5.02
Mean (x_7)	1.66	4.00	3.31
Machinery			
Babcock and Wilcox	.98	3.62	1.38
Cincinnati Milling	1.68	4.19	5.61
Crown Cork and Seal	2.31	2.32	7.99
Ex-Cell-O	1.16	3.22	4.33
Joy Manufacturing	6.34	8.15	15.91
Pitney-Bowes	.83	2.04	2.40
Rex Chainbelt	2.61	4.31	7.31
Mean (x_8)	2.27	3.98	6.42
Mining			
American Smelting	2.65	5.40	7.67
Anaconda	2.45	8.01	4.42
Freeport	3.05	5.14	1.62
International Nickel	1.38	3.57	1.95
Kennecott Copper	2.79	11.68	4.38
Phelps Dodge	2.32	8.78	.94
St. Joseph Lead	5.19	5.84	18.05
Mean (x_9)	2.83	6.92	5.58

TABLE 50 (continued)

Industry and Firm	Percentage Variability		
	1959-1968	1964-1968	1959-1963
Paper			
Crown Zellerbach	.63	2.19	.96
International Paper	1.34	4.09	1.90
Kimberly-Clark	.78	1.82	.65
Scott Paper	.35	.64	.98
St. Regis	2.46	4.86	4.63
Union Camp	1.31	4.80	1.34
Weyerhaeuser	3.36	5.47	6.38
Mean (x_{10})	1.46	3.41	2.41
Retail			
Federated	.49	.32	1.48
Grant	2.67	2.42	5.96
Kresge	3.33	1.89	3.04
Macy	1.27	.99	1.27
Marshall Field	1.02	1.04	.55
Newberry	9.42	4.89	18.99
Penney	1.20	1.79	2.34
Woolworth	.99	2.62	1.43
Mean (x_{11})	2.55	2.00	4.38
Steel			
Armco	2.69	8.47	5.27
Bethlehem	1.61	4.19	4.33
National	3.13	3.52	11.56
Republic	2.05	3.80	6.72
Youngstown	2.15	3.77	5.70
Mean (x_{12})	2.33	4.75	6.72

TABLE 51

OIBD Variability Data

Industry and Firm	Percentage Variability		
	1959-1968	1964-1968	1959-1963
Aircraft			
Boeing	2.02	3.95	6.73
Lockheed	2.89	3.33	8.07
McDonnell	6.85	35.29	5.49
Rockwell	2.22	3.06	4.58
United Aircraft	2.30	2.31	7.71
Mean (x_1)	3.26	9.59	6.52
Aluminum			
Alcan	1.02	3.14	1.59
ALCOA	1.55	3.07	3.85
Kaiser	1.46	4.61	1.84
Reynolds	2.08	5.68	5.01
Mean (x_2)	1.53	4.13	3.07
Auto Parts			
Bendix	2.23	2.83	1.44
Budd	4.63	12.75	18.51
Clark	3.25	3.57	13.83
Eaton	2.60	5.39	9.38
Fruehauf	2.99	6.05	12.92
Houdaille	1.26	3.61	4.43
LOF	2.10	6.14	4.15
Scovill	2.59	5.62	5.04
Mean (x_3)	2.71	5.75	8.71

Source: Computed from Dominick and Dominick (9).

TABLE 51 (continued)

Industry and Firm	Percentage Variability		
	1959-1968	1964-1968	1959-1963
Chemicals			
Allied	1.03	3.00	2.49
Atlas	1.39	1.41	1.46
Chemetron	2.37	7.56	3.77
Hercules	.72	2.31	1.81
Monsanto	1.20	1.14	2.57
Olin Mathieson	1.71	7.15	2.02
Stauffer	1.12	2.03	1.80
Union Carbide	.79	1.89	1.89
Mean (x_4)	1.29	3.31	2.23
Construction			
Allis-Chalmers	5.81	22.59	10.75
Bucyrus-Erie	5.08	5.78	19.70
Caterpillar	2.22	4.54	3.32
Flintkote	.99	2.61	1.74
Ingersoll-Rand	1.12	2.89	1.29
Pullman	4.54	8.86	9.52
Mean (x_5)	3.29	7.88	7.72
Drugs			
Abbott	1.09	1.61	4.35
American Cyanamid	1.21	4.27	2.52
Kendall	.61	1.56	.85
Merck	1.20	2.52	2.12
Schering	1.38	1.69	3.27
SKF	.43	1.06	1.14
Sterling	.54	.86	.10
Warner-Lambert	.35	1.18	.84
Mean (x_6)	.85	1.84	1.90

TABLE 51 (continued)

Industry and Firm	Percentage Variability		
	1959-1968	1964-1968	1959-1963
Glass			
Anchor Hocking	2.24	2.77	.96
Corning Glass	1.27	5.02	3.10
Owens-Illinois	1.25	3.10	3.12
PPG Industries	1.01	2.12	3.91
Mean (x_7)	1.44	3.25	2.77
Machinery			
Babcock and Wilcox	1.07	4.08	.89
Cincinnati Milling	1.50	3.47	4.08
Crown Cork and Seal	1.95	1.67	7.45
Ex-Cell-O	.96	2.00	2.48
Joy Manufacturing	7.09	6.61	19.52
Pitney-Bowes	.60	.98	2.06
Rex Chainbelt	2.31	3.51	7.05
Mean (x_8)	2.21	3.19	6.22
Mining			
American Smelting	4.07	6.06	6.87
Anaconda	2.17	6.66	4.34
Freeport	2.71	4.31	1.66
International Nickel	1.11	3.29	1.46
Kennecott Copper	2.32	9.34	3.03
Phelps Dodge	2.22	8.73	1.12
St. Joseph Lead	6.37	7.22	22.96
Mean (x_9)	3.00	6.52	5.92

TABLE 51 (continued)

Industry and Firm	Percentage Variability		
	1959-1968	1964-1968	1959-1963
Paper			
Crown Zellerbach	.42	1.37	.71
International Paper	1.10	3.10	1.49
Kimberly-Clark	.75	1.20	1.34
Scott Paper	.38	.36	.76
St. Regis	1.54	2.39	4.55
Union Camp	.99	2.76	.98
Weyerhaeuser	2.38	4.61	3.80
Mean (x_{10})	1.08	2.26	1.95
Retail			
Federated	.43	.59	1.26
Grant	2.14	2.27	4.59
Kresge	2.78	.94	.59
Macy	1.16	1.11	1.01
Marshall Field	.87	.82	.52
Newberry	6.55	3.17	12.83
Penney	1.15	1.52	2.04
Woolworth	.82	1.25	1.04
Mean (x_{11})	1.99	1.46	2.99
Steel			
Armco	1.75	5.03	3.76
Bethlehem	.76	2.22	1.48
National	2.15	1.37	7.36
Republic	1.49	2.84	4.93
Youngstown	1.68	.82	4.19
Mean (x_{12})	1.57	2.46	4.34

TABLE 52

Earnings Variability Risk Class Composition
Based on EBIT--1959-1968

Risk Classes (Percent)

.35-1.02		1.08-1.69		1.82-2.79		2.91-3.81		5.19-11.76	
Ind.*	Firm*	Ind.	Firm	Ind.	Firm	Ind.	Firm	Ind.	Firm
4	4	2	1	1	1	1	2	1	3
6	6	3	6	1	4	1	5	3	2
6	7	4	5	2	2	2	4	5	1
6	8	4	6	2	3	3	3	5	2
8	1	4	7	3	1	3	4	5	6
8	6	4	8	3	5	3	8	8	5
10	1	5	4	3	7	4	3	9	7
10	3	5	5	4	1	5	3	11	6
10	4	6	1	4	2	9	3		
11	1	6	2	7	1	10	7		
11	5	6	3	8	3	11	3		
11	8	6	4	8	7	12	3		
		6	5	9	1				
		7	2	9	2				
		7	3	9	5				
		7	4	9	6				
		8	2	10	4				
		8	4	11	2				
		9	4	12	1				
		10	2	12	4				
		10	6	12	5				
		11	4						
		11	7						
		12	2						

*Corresponds to industry number and firm number by industry listed in Appendix A.

TABLE 53

Earnings Variability Risk Class Composition
Based on OIBD--1959-1968

Risk Classes (Percent)									
.35-.87		.96-1.27		1.38-1.95		2.02-2.99		3.25-7.09	
Ind.*	Firm*	Ind.	Firm	Ind.	Firm	Ind.	Firm	Ind.	Firm
4	4	2	1	2	2	1	1	1	3
4	8	3	6	2	3	1	2	3	2
6	3	4	1	4	2	1	4	3	3
6	6	4	5	4	6	1	5	5	1
6	7	4	7	6	5	2	4	5	2
6	8	5	4	8	2	3	1	5	6
8	6	5	5	8	3	3	4	8	5
10	1	6	1	10	5	3	5	9	1
10	3	6	2	12	1	3	7	9	7
10	4	6	4	12	4	3	8	11	6
11	1	7	2	12	5	4	3		
11	5	7	3			5	3		
11	8	7	4			7	1		
12	2	8	1			8	7		
		8	4			9	2		
		9	4			9	3		
		10	2			9	5		
		10	6			9	6		
		11	4			10	7		
		11	7			11	2		
						11	3		
						12	3		

*Corresponds to industry number and firm number by industry listed in Appendix A.

TABLE 54

Earnings Variability Risk Class Composition
Based on EBIT--1964-1968

Risk Classes (Percent)

.32-1.99		2.04-3.92		4.09-5.84		6.15-37.68	
Ind.*	Firm*	Ind.	Firm	Ind.	Firm	Ind.	Firm
6	1	1	4	1	1	1	3
6	3	1	5	1	2	2	3
6	5	2	1	2	2	2	4
6	6	3	1	3	7	3	2
6	7	3	3	5	3	3	4
6	8	3	5	5	4	3	8
10	3	3	6	6	2	4	1
10	4	4	2	7	2	4	3
11	1	4	4	7	3	4	6
11	3	4	5	8	2	5	1
11	4	4	7	8	7	5	2
11	5	4	8	9	1	5	6
11	7	5	5	9	3	8	5
		6	4	9	7	9	2
		7	1	10	2	9	5
		7	4	10	5	9	6
		8	1	10	6	12	1
		8	3	10	7		
		8	4	11	6		
		8	6	12	2		
		9	4				
		10	1				
		11	2				
		11	8				
		12	3				
		12	4				
		12	5				

*Corresponds to industry number and firm number by industry listed in Appendix A.

TABLE 55

Earnings Variability Risk Class Composition
Based on OIBD--1964-1968

Risk Classes (Percent)							
.36-1.89		2.00-3.61		3.95-5.78		6.05-35.29	
Ind.*	Firm*	Ind.	Firm	Ind.	Firm	Ind.	Firm
4	2	1	2	1	1	1	3
4	5	1	4	2	3	3	2
4	8	1	5	2	4	3	5
6	1	2	1	3	4	3	7
6	3	2	2	3	8	4	3
6	5	3	1	5	2	4	6
6	6	3	3	5	3	5	1
6	7	3	6	6	2	5	6
6	8	4	1	7	2	8	5
8	3	4	4	8	1	9	1
8	6	4	7	9	3	9	2
10	1	5	4	10	7	9	5
10	3	5	5	12	1	9	6
10	4	6	4	12	5	9	7
11	1	7	1				
11	3	7	3				
11	4	7	4				
11	5	8	2				
11	7	8	4				
11	8	8	7				
12	3	9	4				
		10	2				
		10	5				
		10	6				
		11	2				
		11	6				
		12	2				
		12	4				

*Corresponds to industry number and firm number by industry listed in Appendix A.

TABLE 56

Earnings Variability Risk Class Composition
Based on EBIT--1959-1963

Risk Classes (Percent)

.36-1.00		1.27-2.40		2.61-4.66		5.02-6.88		7.31-52.89	
Ind.*	Firm*	Ind.	Firm	Ind.	Firm	Ind.	Firm	Ind.	Firm
3	1	4	4	2	1	1	3	1	1
5	5	4	5	2	3	1	4	1	2
6	7	4	6	3	6	2	4	1	5
6	8	5	4	3	7	7	4	2	2
9	6	6	3	4	1	8	2	3	2
10	1	6	6	4	2	10	7	3	3
10	3	7	1	4	3	11	2	3	4
10	4	8	1	4	7	12	1	3	5
11	5	8	6	4	8	12	4	3	8
		9	3	5	3	12	5	5	1
		9	4	6	1			5	2
		10	2	6	2			5	6
		10	6	6	4			8	3
		11	1	6	5			8	5
		11	4	7	2			8	7
		11	7	7	3			9	1
		11	8	8	4			9	7
				9	2			11	6
				9	5			12	3
				10	5				
				11	3				
				12	2				

*Corresponds to industry number and firm number by industry listed in Appendix A.

TABLE 57

Earnings Variability Risk Class Composition
Based on OIBD--1959-1963

Risk Classes (Percent)

.10-1.14		1.26-2.12		2.48-4.19		4.34-5.49		6.73-22.96	
Ind.*	Firm*	Ind.	Firm	Ind.	Firm	Ind.	Firm	Ind.	Firm
6	3	2	1	2	2	1	3	1	1
6	6	2	3	3	7	1	4	1	2
6	7	3	1	4	1	2	4	1	5
6	8	4	2	4	3	3	6	3	2
7	1	4	4	4	5	3	8	3	3
8	1	4	6	5	3	6	1	3	4
9	6	4	7	6	2	9	2	3	5
10	1	4	8	6	5	10	5	5	1
10	4	5	4	7	2	11	2	5	2
10	6	5	5	7	3	12	4	5	6
11	3	6	4	7	4			8	3
11	4	8	6	8	2			8	5
11	5	9	3	8	4			8	7
11	8	9	4	9	5			9	1
		10	2	10	7			9	7
		10	3	12	1			11	6
		11	1	12	5			12	3
		11	7						
		12	2						

*Corresponds to industry number and firm number by industry listed in Appendix A.

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David F. Scott, Jr., was born February 17, 1942, at Utica, New York. In June, 1960, he was graduated from Meadville Area Senior High School, Meadville, Pennsylvania. In June, 1964, he received the degree of Bachelor of Science in Business Administration from the University of Akron. He worked as a cost analyst for Ford Motor Company and Massey-Ferguson, Ltd., while attending the University of Detroit, from which he received the degree of Master of Business Administration in April, 1967. In June, 1967, he enrolled in the Graduate School of the University of Florida. He worked as a graduate assistant in the Department of Finance and Insurance from September, 1967, until June, 1968, and as an Instructor from June, 1968, until June, 1970, while pursuing his work toward the degree of Doctor of Philosophy.

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This dissertation was prepared under the direction of the chairman of the candidate's supervisory committee and has been approved by all members of that committee. It was submitted to the Dean of the College of Business Administration and to the Graduate Council, and was approved as partial fulfillment of the requirements for the degree of Doctor of Philosophy.

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